RAILROAD GAZETTE

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CONTENTS.

ILLUSTRATIONS:

New Locomotives of the Chicago, Burlington & Quincy—with an Inset. . 195
A Mogul Engine for the New York Central 197
Some Questions in Locomotive Design 198
New Office Building of the Westinghouse Electric Co 196
The Union "4-C" Relay.. 205

CONTRIBUTIONS:

Lubrication..... 195
Nickel Steel Rails on the Pennsylvania 195
The Railroad Spiral..... 195

EDITORIALS:

"Brittle" Rails and Phosphorus Content..... 202
Ten Years' Railroad Progress in Russia..... 203
Annual Reports — Missouri Pacific; Texas Pacific..... 203

EDITORIAL NOTES.....202, 204

GENERAL NEWS:

Locomotive Building..... 207
Car Building..... 207
Bridge Building 207
Meetings and Announcements 208
Personal 208
Elections and Appointments..... 209
Railroad Construction..... 209
General Railroad News ... 210

MISCELLANEOUS:

Technical..... 205
The Scrap Heap 206
Signaling as It Is and As it Might Be 196
Distant Signal Wires Enclosed in Pipes 197
The New Line to London.. 197
Purchasing Under Specifications 199
Problem of Pure Water for Steam Boilers.—II..... 200
Applications of Compressed Air in Railroad Shop Practice 201
Technical Schools and the Railroads 201
Notes on the Eastern Railroad of France 204
Sizes of Freight Cars in Australia..... 204

Contributions.

Lubrication.

New York, March 10.

To the Editor of the Railroad Gazette:

For quite a number of years I have been obliged to pay a good deal of attention to the matter of lubrication, working in the interest of one of the great commercial companies. My work has been principally in big mills and I have come to realize that the railroads are the only companies that have ever figured oil cost down to something like a fine point and that know how to get the best results from the least amount of oil. The waste in some of the big mills and steel works is shocking. Those who supply lubricants to such works frequently make tonnage contracts by which they agree to furnish all lubricants at a cost not to exceed so much per ton of output of the works. When the cost actually runs above the contract price it is almost impossible to get an engineer to reduce his oil feed to a reasonable amount.

A. B. C.

Nickel Steel Rails on the Pennsylvania.

Pennsylvania Railroad Company,
Philadelphia, March 26, 1900.

To the Editor of the Railroad Gazette:

On June 26, 1899, we placed an order with the Carnegie Steel Co. for 300 tons of steel rails to contain 3 per cent. nickel. The material was made by the Bessemer process and rolled in the American Society pattern 100-lb. section the last week in July, 1899; but the nickel content caused "red shortness" to such an extent that the rolling resulted in only 220 tons of No. 1 and 57 tons of No. 2 rails, and we had to throw out 19 tons of the latter because of "piping."

The average analysis was as follows: Carbon 0.504 per cent; phosphorus, 0.094 per cent.; manganese, 1 per cent., and nickel, 3.22 per cent.

Under the straightening presses the rails showed great rigidity; twice the force ordinarily used being required to accomplish the cold straightening, and often the rail would spring back to its former position after being struck, showing no effect of the blow.

In drilling the hardness was even more marked; in some cases five twist drills of ordinary tool steel being used up in drilling one hole. After experimenting with different materials for drills, it was found the best results were obtained by using Mushet steel without lubrication.

These rails are laid on the west track on the Horse Shoe Curve, but they have not been in service long enough to enable us to say much about the wearing qualities.

WM. H. BROWN,
Chief Engineer.

The Railroad Spiral.

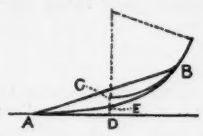
Elkins, W. Va., March 9.

To the Editor of the Railroad Gazette:

Will you be good enough to give one or two examples illustrating the use of the formulas of your editorial of February 9 on "The Railroad Spiral," and oblige

S.

[The first formula given was that of Mr. Wellington $L = 1.86\sqrt{\frac{O}{D}}$, in which L is the half length, AE, of the spiral measured in stations, O is an assumed offset, CD, from tangent to off-setted main curve, and D, the degree of the main cure. If O assumed at 1.0 ft. for a 4° curve, L = .93 and the whole spiral will be 186 ft. long. In the other formulas of the article O and D have the same significance as above, but L is the length in feet, AEB, of the whole spiral. L is determined by assuming that the elevation of the outer rail shall be attained at some definite rate as, say, 1 in 300. Suppose the elevation of the outer rail on a 4° curve is 1/3 ft. and is desirable to reach this at a a rate of 1 in 600; the length of spiral will be 1/3 of 600, or 200 ft.; then O =



$$\frac{L^2}{24\,R} = \frac{200^2}{24 \times 1{,}432.5} = 1.163 \text{ ft.}$$

With this explanation we think the remaining formulas here repeated and referred to the figure above, will be well be well understood.

$$\sigma = B\,A\,D = \frac{L}{6\,R} = \frac{4}{L}\frac{O}{} = \sqrt{\frac{2\,O}{3\,R}} = \text{in minutes } \frac{L\,D}{10}.$$

$$t = A\,D = \frac{L}{2} - \frac{5}{2}\frac{O^2}{L}$$

$$C = A\,B = L - \frac{32}{5}\frac{O^2}{L}$$

} The subtractive term is useful only with large O's.]

New Locomotives of the Chicago, Burlington & Quincy.

[WITH AN INSET.]

In this issue are shown the new freight locomotives and six-wheel switchers of the Chicago, Burlington & Quincy, four of each having recently been built in the company's shops at Aurora and West Burlington. For the drawings and other data we are indebted to the designers, Mr. F. A. Delano, Superintendent of Motive Power, and Mr. F. H. Clark, Mechanical Engineer of that road.

Freight Locomotives.

For a number of years the standard freight locomotive of the Chicago, Burlington & Quincy has been the class "H" mogul and the latest engines of this class have 2,048 sq. ft. of heating surface, 30 sq. ft. of grate area, 121,500 lbs. weight on the driving wheels, and a total weight of 143,000 lbs.; the firebox is 3 ft. 4 in. wide by 9 ft. long. These engines have given good service, but to meet the requirements for greater boiler capacity, economy of fuel consumption and simplicity of firebox design a new freight locomotive has been designed which in several respects differs from engines built heretofore. As stated, four of these are now about completed and will be known as the class "R," or "Prairie" type, in contradistinction to the Atlantic type. They are particularly interesting as an application of a wide and deep firebox suitable for bituminous lump coal.

The modified Wootten firebox used with low-grade anthracite coal has never been considered favorably by Western roads burning hard bituminous coals, and they appear unnecesarily wide and entirely too shallow. It may be said that the chief object in the design of the class "R" engines was to get a fair increase in grate area, a deep firebox, and a low-hung engine which would ride safely over any kind of track. Such a firebox makes necessary certain modifications in the wheel arrangement and frame construction which would not be advisable if tractive effort were the chief requirement, the engine having been designed for low grades. The class "R" engines have a single or pony truck, in front, three coupled drivers and a pair of trailing wheels, a combination which has been named the "Prairie" type to distinguish it from other wheel arrangements. In this instance the middle drivers have no flanges.

The principal features are shown in Figs. 1 and 2, being respectively an elevation and sections. The total weight of the engine in working order is estimated at 140,000 lbs., of which about 96,000 lbs. is on the drivers, 20,000 lbs. on the leading and 24,000 lbs. on the trailing wheels. The cylinders are 19 x 24 in., the steam pressure is 190 lbs. and the driving wheels are 64 in. in diameter, making the maximum theoretical tractive power about 21,700 lbs. or 22.6 per cent. of the adhesive weight. It will be seen that the engine is best suited for fast freight service on fairly level track where the boiler capacity governs the train load.

The boiler is of the Belpaire type, and has 139 sq. ft. of firebox heating surface and 1,937 sq. ft. of tube heating surface, or a total of 2,076 sq. ft. The grate is 6 ft. wide and only 7 ft. long, making an area of 42 sq. ft., but it is proposed to start the brick arch from a low wall in the front of the firebox, which plan, if carried out, will reduce somewhat the grate area. The depth of the firebox is 62¾ in. at the front and 56 in. at the rear.

The novel features of the firebox are shown in Fig. 3, and attention may be called to the water legs which slope outward. The side sheets are straight to within a few inches of the mud ring, where the water spaces are 4½ in., gradually increasing to 7 in. at the top. The unusually large water spaces will doubtless prolong the life of staybolts and side sheets, and it is anticipated that in these respects better results will be obtained than with former engines. The boiler is not so wide at the rear that the cab has to be placed forward. Two fire doors are provided and considering the short grates, it is reasonable to suppose that the work of firing will be better done, which together with the lower rates of combustion should result in economies. Although a very short extension front is used, the smokebox is 5 ft. 5 in. long. This became necessary as the length of the barrel was determined by the driving wheels clearing the firebox at one end, and the cylinders at the other, and the fact that it was not considered advisable to make the tubes longer than 16 ft. 1 in.

The cylinder arrangement is apparent from Fig. 4 and the details of the piston valves are shown in Fig. 5. In this valve the number of parts is much less than in the first ones used. It consists essentially of the valve body, a single casting through which the valve rod extends, two bull rings and the packing rings, all being held in place by a single nut and cotter on the end of the valve rod. This arrangement of piston valve is doubtless the best so far brought out, and weighs about 40 per cent. less than a similar Allen slide valve. The link motion has been modified, as shown in Fig. 1, so that longer eccentric rods can be used. This modification consists in an extension bar connecting the link block and the rocker shaft, the extension bar being attached to the rocker shaft at the rear and suspended at the forward end by a hanger. Laird cast steel crossheads are used, the upper guide bar being of cast iron, while the lower bar is made of forged steel, so that the depth of the crosshead may be as little as possible. The piston rods, 3¼ in. in diameter, are steel with a 3¾-in. collar at the piston and a 4-in. collar at the crosshead, large fillets being used where there are changes in diameter. Where the rods enter the piston and crosshead the taper is ¼ in. in 5 in., and a single nut is used at either end.

The only changes in the frame construction are at the firebox end where there is an offset of 16½ in. From Figs. 1 and 6, it will be seen that a heavy cast steel cross bar is used at the front of the firebox to which both sections of the frame are attached; a somewhat similar cross bar forms the connection at the rear. The journal boxes of the trailing wheels work in pedestals and the bearings of that axle are outside the wheels. This gets the rear journals well away from the heat and dirt of the ash pan, and where they can be easily inspected. The front pair of drivers and the leading wheels are equalized together in the usual manner, and the main and rear drivers and the trailing wheels form another group. A cross bar is placed just forward of the trailing wheels, to which are connected the equalizers in front and back of that point as shown in Fig. 1. The seat of the rear equalizers is supported by two stirrups made of round steel which extend up and end in eyes; a rod passes through the eyes of each stirrup and transmits the load to the top of the journal box. The trailing axle is given 1 in. play, which, if required, can be increased to 3 in.

The details of the expansion pads are clearly shown in Fig. 7, and Fig. 1 gives the arrangement of the brake gear, the brake cylinder being placed under the boiler barrel and between the two rear drivers. The principal dimensions are given below along with those of the new six-wheel switchers.

Six-Wheel Switching Locomotives.

Fig. 8 shows the construction of these engines, which are estimated to weigh, in working order, 122,000 lbs. The cylinders are 20 x 24 in., the driving wheels 52 in., and the steam pressure 180 lbs., which makes the maximum theoretical tractive effort about 26,500 lbs., or 22 per cent. of the tractive weight. The novel feature of this class of engines, the "G3," is the boiler, Fig. 9, which has a firebox extending outside the frames, but differing from the class "R" boiler in that it is of the straight top, radial stay type, with vertical side sheets. Also, on account of the different service requirements, the firebox is made shorter and narrower, being only 6 ft. long, 4 ft. 6¼ in. wide and 58½ in. deep; the grate area is 27 sq. ft. There are 1,732 sq. ft. of tube heating surface and 106 sq. ft. of firebox heating surface, a total of 1,838 sq. ft., which is very large for a switch engine. In these engines the frames are not offset, but the firebox is carried on expansion pads which rest on brackets bolted to the frame as shown by Fig. 10.

The same design of piston valves is used as in the class "R" engines and the cylinder arrangement, guides, crossheads and piston rods are also similar. The pistons, however, are "Z" shape, Fig. 11, and made of cast iron. The advantage of this form is that in casting no cores are needed, and it is easily determined whether the piston is of the required thickness. With some styles of box pistons there is more or less uncertainty about the thickness of the walls.

The principal dimensions of the class "R," Prairie type, and the class "G3," six-wheeler switcher, are as follows:

Type	Prairie.	Six-wheel.
Class	R.	G3.
Name of builder	Chicago, Burlington & Quincy	"
" operating road	"	"
Gage	4 ft. 8½ in.	

Simple or compound (both)	Simple.	
Kind of fuel to be used (both)	Bituminous coal.	
Weight on drivers	96,000 lbs.	122,000 lbs.
" truck wheels	20,000 lbs.	.....
" trailer wheels	24,000 lbs.	.....
Weight, total	140,000 lbs.	122,000 lbs.
" tender loaded	96,000 lbs.	75,000 lbs.
Wheel base, total, of engine	26 ft. 3 in.	10 ft. 10 in.
" driving	11 ft. 4 in.	10 ft. 10 in.
" total (engine and tender)	51 ft. 4 in.	38 ft. 9¼ in.
Length over all, engine	37 ft. 11 in.	.....
" " total, engine and tender	60 ft. 6⅛ in.	.....
Height, center of boiler above rails	7 ft. 10 in.	7 ft. 10½ in.
" of stack above rails	15 ft.	14 ft. 6¼ in.
Heating surface, firebox	139 sq. ft.	106 sq. ft.
" " tubes	1,937 sq. ft.	1,732 sq. ft.
" " total	2,076 sq. ft.	1,838 sq. ft.
Grate area	42 sq. ft.	27 sq. ft.
Drivers, diameter	64 in.	52 in.
" material of centers (both)	Cast iron.	
Truck and trailer wheels, diameter	37 in.	.....
Journals, driving axle, size	8½x9½ in.	9x10½ in.
" truck " "	5½x9 in.	.....
Cylinders, diameter	19 in.	20 in.
Piston, stroke	24 in.	24 in.
" rod diameter (both)	3¼ in.	
Kind of piston rod packing (both)	Metallic.	
Main rod, length center to center	6 ft. 3¼ in.	6 ft. 1⅛ in.
Steam ports, area (both)	35 sq. in.	
" width (both)	1⅛ in.	
Exhaust ports, area (both)	69.5 sq. in.	
" width (both)	3 in.	
Bridge, width (both)	1¾ in.	
Valves, kind of (both)	10-in. piston.	
" greatest travel (both)	6 in.	
" outside lap	1 in.	¾ in.
" clearance	⅛ in.	0 in.
" lead in full gear	.....	.....
Boiler, type of	Belpaire.	Straight top. Radial stay.
" working steam pressure	190 lbs.	180 lbs.
" material in barrel (both)	Steel.	
" thickness of material in barrel	⅝ in.	9/16 in.
Boiler, diameter of barrel	56 in.	60 in.
Seams, kind of horizontal (both)	Butt.	
" " circumferential (both)	Lap.	
Thickness of tube sheets (both)	½ in.	
" crown sheets (both)	⅝ in.	
Crown sheet stayed with (both)	Radial stay.	
Dome, diameter (both)	28¼ in.	
Firebox, length	7 ft.	6 ft. 0 in.
" width	6 ft.	4 ft. 6¼ in.
" depth, front	62¼ in.	58⅛ in.
" " back	56 in.	58⅛ in.
" material (both)	Steel.	
" thickness of sheets (both)	⅜ in.	
" brick arch ? (both)	Yes.	
" water space, width (both)	Front, 4⅛ in.; sides, 4⅛ in.; back, 4⅛ in.	
Grate, kind of (both)	Shaking and rocking.	
Tubes, number	194	204
" material (both)	Wrought iron.	
" outside diameter (both)	2¼ in.	
" length over sheets	16 ft. 1 in.	14 ft. 6 in.
Smokebox, diameter	57½ in.	61½ in.
" length (both)	65 in.	
Exhaust nozzle (both)	Single.	
" " "	Permanent.	
Netting (both)	Wire.	
" size of mesh (both)	2½x2½ in.	
Stack (both)	Taper.	
" least diameter (both)	14 in.	
" greatest diameter (both)	19½ in.	
" height above smokebox	.....	4 ft. 2 in.
Tender.		
Type (both)	Swivel truck.	
Tank capacity for water	5,000 gals.	3,900 gals.
Coal capacity	8 tons.	6 tons.
Kind of material in tank (both)	Steel.	
Thickness of tank sheets (both)	3/16 and ¼ in.	
Type of under-frame	Wood with steel center sills.	Composite.
Type of truck (both)	Diamond frame.	
Truck with swinging motion or rigid bolster (both)	Rigid.	
Type of truck spring (both)	Elliptic.	
Diameter of truck wheels	36 in.	33 in.
Diam. and length of axle journals	5x9 in.	4¼x8 in.
Distance between centers of "	5 ft. 6 in.	6 ft. 3 in.
Type of truck bolster	.....	Steel.
Type of truck transom	.....	Channel.
Length of tank	19 ft.	.....
Width of tank	9 ft. 6 in.	.....
Height of tank, not including collar	4 ft. 10½ in.	.....
Type of back drawhead (both)	M. C. B. coupler.	
With or without water scoop (both)	Without.	
Special Equipment.		
Sight-feed lubricators (both)	Michigan.	
Bell ringer	Plattsmouth.	Crandall.
Couplers	Leeds pilot at front.	Chicago.
Muffler	.....	Consolidated S. V. Co.
Sanding devices	"She."	Leach.
Driver brake equipment (both)	Westinghouse.	
Tender " " "	Westinghouse.	
" " beam (both)	Monarch.	
Driver " shoe "	Ross-Mehan.	
Piston rod packings (both)	C. C. Jerome.	
Valve "	Dunbar.	C. C. Jerome.

Signaling As It Is and As It Might Be.

THE SIGNAL ENGINEER AND HIS FORCES TO-DAY.

BY A. H. RUDD.

(*Continued from page* 148.)

To the uninitiated the position of this man is a "snap." Usually he does not have to work with his hands; he sits in the office, writes a few letters, and frequently makes pictures, which do not take much time, and which almost anyone could do; sometimes he even has a draughtsman to help him, and possibly a clerk. He rides over the road, and occasionally may be seen examining the different plants, and somehow he manages to keep busy. How easily he earns his salary! This varies from $1,000 to $2,000 a year. Perhaps the usual rate for such services is in the neighborhood of $1,800. At the lowest rate he receives nearly as much as a first-class locomotive engineer, and even more than many conductors. His maximum rate, however, is less than that of the two men combined, who are responsible for the safety of any single train or engine running over the road. But by his carelessness in installation or maintenance, by lax methods of conducting his department, in choosing his assistants, or in keeping them up to their work, he has every such train at his mercy; and its crew, depending entirely on signals, as they frequently now do, may be led into death traps through his instrumentality, no matter how careful they may be.

The locomotive runner has great responsibility for a limited time each day, but the strain is then relieved for a longer period; the Signal Engineer's work is never done. The strain is constant, and being subject to call at all hours, his time is rarely his own. This is particularly true under the division arrangement. Is this fact recognized by his superior officers? The men who have these departments in charge to-day are for the most part young, signaling being a comparatively new branch of railroading. They are intelligent and active, and as a class are enthusiastic; and most of them are ambitious.

The writer knows of such a one, who remodelled a system under his charge, effecting a yearly saving in battery maintenance alone of more than his salary, who each year reduced the cost of maintenance of his signals, while at the same time the percentage of failures was also lessened, this covering a period of over four years. At last he was compelled to use his maintenance forces so much for construction work that the failures increased appreciably, and surprise was expressed at the poor showing. He was naturally pleased at the appreciation of his efforts.

Signal engineers may be divided into two classes: Specialists, and all-round railroad men. What are the chances of advancement for such men? According to the present outlook there is little ahead. This is an age of specialists, and if a man desires to reach the head of his profession, even in signaling, he must practically give his life to it. The problems are innumerable. New conditions are constantly developing. Every energetic man is working to better the service, and any new idea of one is usually given to all, through the instrumentality of the growing Signaling Club, and if a new idea is good it is put into use all over the country. It is a constant study to keep abreast of the times. Many signal engineers have not time at their disposal to devote to such development, though all can see that this advancement ought to be recognized as a part of a signal engineer's duties.

There are three courses open to these men. The signal companies pay far better salaries than the railroads, and there is room for a limited number of the best in their employ. Others may become heads of new departments on other roads, and if very fortunate, attain the heights, and get $2,000 a year. Is this worth the while of a brainy, active man, when the possibilities in other fields are considered? Lastly, if they do not like their treatment or their prospects, they are at perfect liberty at any time to quit the business (and large numbers of them have done so). The first opportunity noted is of necessity very limited; the second is within reach of the majority. But not one signal engineer in ten would continue in the work if he had not a faint and lingering hope of something better than this eventually. Most of them are living in hope, and "hope deferred maketh the heart sick."

In the engineering department there always looms up the possibility of becoming chief; in the motive power, the Superintendent's office may some day be attained; and the same is true of most other branches. Any of these positions are worth years of work to obtain, but the summit of the signal department grade is in a valley compared with these altitudes. There is room at the top, but that top is pretty near the bottom of other departments.

There are signal engineers who fit their places well, and are contented to go on with no hope of advancement, for they fear added responsibility; but they are not the men that progressive managements are looking for. Suppose, on the other hand, a man can find time from his routine work to study transportation problems (and many come before him, in a limited way, in the handling of trains at junctions, terminals, etc., where if his eyes are open he can learn much); to examine roadway methods and work where his opportunities (at interlockings) are also first-class; and look into motive power practice until he knows as much about it as the average division superintendent. Are opportunities afforded him at present for any advancement on these lines? There have been one or two cases of such promotion, but as a general rule, when an assistant or division superintendent is required, do the officers ever think of turning to the signal department? Civil engineers, roadmasters, despatchers, conductors, or freight agents are usually chosen, and yet there is very good material in our department on several roads; men who can and do handle their own forces successfully (and competent signal workmen in good times are a pretty independent lot), men who appreciate the need of good track and ample protection, and know how to give it; men whose study has fitted them to meet successfully any conditions that may arise, and of sufficiently good address to make a favorable impression upon their patrons and the general public; men with broad views and a good education. Should they not be considered when higher positions are vacant?

If the science of signaling is to be advanced in the future, as it has been in the past, and in order also that protection may be of the best, and absolutely sure, it must be remembered that the experimental stage is in a large measure finished, and that absolute knowledge of past failures must be possessed by those in authority. Consequently some inducement ought to be offered to keep there those now in the service, who have experience, and to induce the coming generation to take up the study.

This can be done in two ways: either by giving the signal department the importance it deserves, making its head a well paid official, placed more nearly on an equality with the men he consults with, and then employing only the best men, who have proved by past record their thorough competency; with young men of ability under them to be fitted for like positions; or by letting it be definitely understood that the highest position in it is the stepping stone to a better office in a wider field. By these methods an objective worth attaining will be created, and signal engineers will put forth efforts to achieve it and to prove ability to hold it.

If such a condition should be brought about (and some roads are apparently moving in this direction) we should soon see better work done in fitting men for this field. We have in our technical schools courses in mechanical, civil, and electrical engineering, and men graduated by them, after a few years (in the majority of cases) attain positions of importance, and many times of high salaries. Under the suggested conditions, signal engineering would also be recognized. Courses of study, and lectures with practical illustrations, would be instituted, and the technical training and theory thus obtained would, in connection with a few years' practical work, be of great value in developing a superior class of men.

All of us to-day are handicapped in a measure, as they would not be, in that we have had to take our theory in homeopathic doses, as we could absorb it in connection with our work. Many a weary hour has been spent in projected improvements and development, when a little theory of the right sort, used almost unconsciously, would have lightened the labor and saved time. Some have had the advantages of electrical training, some of mechanical, but very few of the combination of the two, which is necessary in the well rounded development required for successful work.

The Signal Force.

It will be noted from a preceding table that the rate of pay of these men is below the average for like kinds of work. A skilled interlocking repairman must have a thorough knowledge of all parts of the machine and connections in order to make repairs quickly and well. His is a position of considerable responsibility, as careless maintenance may easily mean loss of life, and he requires probably more intelligence than a shop mechanic who, as a rule, is confined to one or two machines or classes of work. Fitters must know considerable blacksmithing and carpenter work, beside having the general knowledge of a repairman; they should receive more pay than a carpenter. Foremen and supervisors should be paid proportionately. The positions should be classified so as to make a regular line of promotion, great care being taken in the selection of lampmen in the first place.

Every man employed should be capable of filling a higher position than the one he is chosen for. The wages of lampmen should be a little better than those of track laborers, and bright, active young men should be secured. There will be no difficulty in this if the applicants understand that they actually stand in line of promotion. This is the secret of success in many great departments which employ good men who accept smaller wages, perhaps, than the average but who are contented because they know there is something ahead. If, however, there is good ground for a feeling that higher positions will be filled by skilled men from other roads, work becomes mechanical, interest is lost, and the attempt is made to do as little as possible and keep the place. Until a good organization is built up with our own men, this condition is often unavoidable; but with due care such an organization can be established in a short time, and the good results will be surprising.

Green men can learn to properly care for lamps in a few hours. Almost any one can do the work. But the error should not be committed of employing on this basis. Let the lampman be chosen as indicated above, and instructed to assist the repairman, and he will soon acquire considerable knowledge of mechanical work. Then promote (not degrade) him to the position of helper in the construction gang. In two or three years he will become a good fitter, and soon a repairman, having had experience in all branches of maintenance and construction work. Such a workman knows that the positions of gang and division foreman and inspector are within his reach if he shows the requisite ability, and the results will be better than if higher wages were paid with no hope of future advancement.

In these different classes also the pay may be graded according to length of service and ability. For example, a lampmen may start at $1.50 a day and be increased to $1.60 after a certain time: as helper he would receive $1.75 to $2; as fitter, $2.25 up to $2.50; as repairman, $2.75 up to $3; all by small advances and by transfers to more complicated plants, as opportunities offer.

The wages, of course, vary in different localities, but a scale on the above general lines should be established and adhered to.

In the electrical branch, batterymen usually receive about $50 a month. With a line of promotion, $1.75 a day is a good starter, until they learn maintenance work by assisting the repairman; then promotion follows through the gang, to repairman, etc. We should neither make our departments training schools for the telegraph and telephone companies, nor depend on those companies to furnish us linemen; but should teach our men in the gang to climb and become fair linemen, and after they have mastered the fine points of maintenance, pay them a slight advance over the prevailing wages of "trouble hunters" in the aforesaid companies, as many men now leave us for such positions. Foremen and inspectors should receive enough more to establish a line of promotion.

With this plan conscientiously followed there will always be men ready at hand to fill any vacancies which may occur, except, perhaps, two or three at the very top, where technical education is required.

A course in a correspondence school, or, preferably, in some technical school, followed by a year or two in the interlocking gang, and a similar period with the electrical forces, will fit a man with a trained mind for intelligent work in the draughting room and office; and later for the position of assistant, and finally of signal engineer.

The object of the foregoing has not been to prove that everything is going wrong; for such is not the case. We are advancing, though slowly, and improving all the time. But I have aimed to demonstrate some of the weak points in present general practice, so that if the managements desire it, and will take the necessary steps, progress may be more rapid in the future, until perfect development is attained. With this end in view a few suggestions are offered regarding an ideal organization, which in the writer's opinion is closely approached on several roads; although the fact remains that the departments themselves are not yet placed in the important position which they should occupy; and the intelligence required to manage them is probably not proportionately appreciated and compensated.

But, after all, arguments and opinions do not always convince or carry weight; "the proof of the pudding is in the eating of it," and a statement, if it could be obtained, of the methods of installation, character of the work erected and maintained, reliability of the apparatus, and freedom from failures on such lines as the Lehigh Valley, Michigan Central, Illinois Central, Chicago & Northwestern and others where the signal engineers are in full, unhampered charge, compared with a like statement from some of the lines with equally good forces, where a different system prevails, would make very interesting reading and undoubtedly furnish facts enough to settle the organization question once and for all.

[TO BE CONTINUED.]

Distant Signal Wires Enclosed in Pipes.

As recently noted in the Railroad Gazette, there are a number of distant signals on the Lake Shore & Michigan Southern which are connected to the cabin by wires which are laid in iron pipes beneath the surface of the ground, the pipes, after the wire is inserted, being filled with oil. Mr. E. D. Wileman, Signal Engineer of the road, has given us an account of how these connections are put in, which in substance is as follows:

We have a dozen or more distant signals connected in this way. They are of various lengths, but only two or three have been in use any length of time. The one first put in is at Waterloo, Ind. The line runs through the station ground and through the valve well of a stand pipe. It has been in nearly two years and has given perfect satisfaction. It requires no adjustment except perhaps twice a year; and it works easier and better than any distant signal on the line not so connected.

We enter the pipe as soon as convenient after leaving the wire lock at the derail and continue the pipe as near the distant signal as practicable. The pipe is laid in a box of 1 in. boards, 6 in. wide. The box, without the top board, is laid in a shallow trench which is made as near as possible in a direct line to the signal. It is carried straight under crossovers or turnouts whenever necessary. If the general direction lies along a curved main line we follow that curve just a little farther out than the ends of the ties. The side strips of the box are put on so as to break joints with the bottom about 1 ft., and the top pieces are laid on so as to make a break with both the others of another foot.

The half-inch pipe is looked over and straightened, and a rod is run through to clean out ordinary dirt and roughness. The ends are reamed out and any sections with internal wrinkles or defects likely to injure the wire are culled out. Then this pipe is laid in the box. The wire, which is in one complete length, is kept drawn through each section as it is jointed up so that when the pipe is all in the box the wire is all in the pipe. Then the pipe is covered with hot roofing cement. Coal tar or pitch would be cheaper and probably equally good.

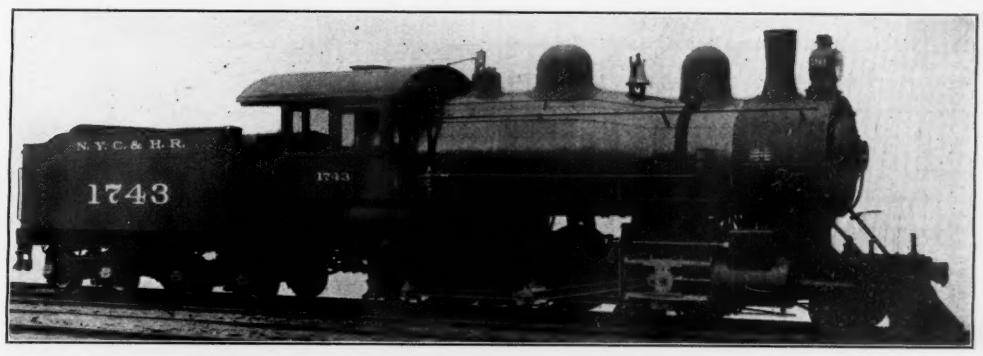
The cover is nailed on as soon as the roofing cement is on. In each line of pipe we insert near the middle a drip well made of a U-shaped 2 in. iron pipe which can be easily pumped empty. In some situations the boxing for the pipe is not absolutely necessary, but where there are cinders in the ground the pipe will soon be corroded if not protected.

A separate ½-in. pipe is used for each wire. At each end we first put on a washer of the right size and then screw a long cap over a packing of wicking and tallow to prevent waste of oil. This is especially necessary if the line is on such a grade that one end is much lower than the other. This packing does not need to be tight enough to interfere in the least with the free movement of the wire. Crude petroleum is used for filling, and the water needs to be pumped out of the well and oil filled in to the pipe about twice a year.

The cost of this arrangement is about $115 per thousand feet.

A Mogul Engine for the New York Central.

The engraving herewith, from a photograph, shows one of the new mogul freight engines building by the Schenectady Locomotive Works for the New York Central & Hudson River Railroad. The designs and specifications were furnished by the mechanical department of the New York Central and were worked out under the direct supervision of Mr. A. M. Waitt, Superintendent of Motive Power and Rolling Stock. A few of the leading weights and dimensions of this engine are compared in tabular form with weights and dimensions of the New York Central moguls described in our issues of June 30 and Sept. 29, 1899:



Mogul Freight Locomotive for the New York Central & Hudson River Railroad.

Mogul Freight Engines—N. Y. C. & H. R. RR.

	Class P, 1898.	Recent Mogul.
Weight in working order	152,000 lbs.	155,200 lbs.
" on drivers	131,600 lbs.	135,500 lbs.
Cylinder diameter and stroke	20 x 28 in.	20 x 28 in.
Diameter of driving wheels.	57 in.	57 in.
Outside diam. of boiler (first ring).	67¼ in.	67⅞ in.
Working pressure per sq. in.	180 lbs.	190 lbs.
Heating surface, tubes	2,372 sq. ft.	2,321.6 sq. ft.
" " firebox	211 sq. ft.	185.6 sq. ft.
" " total	2,583 sq. ft.	2,507.2 sq. ft.

Other particulars of these new engines follow:

Fuel	Bituminous coal
Wheel base, driving	15 ft. 2 in.
Horizontal thickness of piston	4½ x 5 in.
Diam. of piston rod	3¾ in.
Size of steam ports	18 in. x 1¼ in.
" " exhaust	18 in. x 2¾ in.
" " bridges	1⅛ in.
Valves	Richardson balanced
Greatest travel of slide valves	5½ in.
Outside lap " " "	⅞ in.
Inside " " "	Clearance, 1/16 in.
Lead of valves in full gear	⅛ negative lead full gear forward; ⅜ negative lead full gear back
Material of driving wheel centers	Cast steel
Tire held by	Shrinkage
Driving box material	Gun metal
Diam. and length of driving journals	9 in. dia. x 12 in.
" " " " main crank pin journals	(Main side 6¾ x 5¼) 6 in. dia. x 6 in.
" " " side rod crank pin journals	Back, 5 x 3¾; front, 5 in. dia. x 3⅝ in.
Engine truck	Swing bolster
" " journals	6¾ in. dia. x 10 in.
Diam of engine truck wheels	30 in.
Kind " " " "	N. Y. Car Wheel Works Plate
Boiler, style	Extended wagon top
Firebox, length	108⅛ in.
" width	40⅜ in.
" depth	F., 82⅛ in.; B., 70¾ in.
" crown staying	Radial stays 1⅛ in. diam.
Tubes, number	366
" diam.	2 in.
" length over tube sheets	12 ft. 2½ in.
Fire brick, supported on	Studs
Grate surface	30.3 sq. ft.
Exhaust pipes	Single
" nozzles	5 in., 5¼ in. and 5½ in. diam.
Smoke stack, inside diam.	16 in. at choke; 18½ in. at top
Tender, weight, empty	44,700 lbs.
Water capacity	5,000 U. S. gallons
Coal "	10 tons

The New Line to London.

By W. B. Paley.

The result of the first complete half year's working of London's newest railway, the Great Central, is very discouraging and there can be no doubt the company is in a position of some difficulty. Several unforeseen and unpreventable causes partly explain the misfortune, but the worst feature is that the London extension is not yet carrying anything like the traffic that was looked for. Of the total increased traffic receipts, compared with the last half of 1898, of £175,000, nothing whatever is left as increased profit to pay interest on the vast cost of the London line. On the contrary, working expenses are up by the heavy sum of £248,500, leaving the company actually more than £73,000 to the bad, after working, roughly, 100 miles of new line. This, however, by no means fills the cup of bitterness. So much as £50,600 has had to be provided out of revenue for interest upon what are called Lloyd's bonds, a security bearing 4 per cent. interest and issued instead of cash in payment for works and materials put into the line to London. The sum of £22,000 bearing 4¼ per cent. interest has been paid for hire of engines and rolling stock; about the most unsatisfactory form of expense a railway can have. These two securities, by law, take precedence over even the debenture stock and form, as it were, a first charge upon the undertaking. Nothing is added to the reserve fund, which had £7,000 credited to it a year ago; on the contrary £10,000 is now taken from reserve. With an increase of about £9,000 on certain joint line receipts, these extra charges added to the ordinary working expenses come to some £60,000 more, leaving the real deficiency of earnings, in round numbers, £133,000. Consequently, except 1 per cent. upon the 5 per cent. preference stock of 1879, no capital issued after that date receives a penny of interest.

But there are some hopeful features. Steamship receipts are nearly £11,000 greater, at a small increased cost; joint lines nearly as much, though two-thirds of it has gone in higher working cost; and a rise of about £10,000 in compensation for injuries is due to an accident which happened some time before the company went to London, and is not likely to recur. Besides, there is the very solid fact of the general traffic increase of £175,000, which is a great deal for a line of about 453 miles, although the company partly owns some 200 more and with certain running powers works its engines over 952½ miles of railway in all. About 66 miles of line are still under construction, representing a good deal of dormant capital, though part of it will not be wholly owned by the Great Central.

After all, it is too much to expect that the new line should pay its way from the first. Wonderful as is the volume of trade between London and the districts it serves, the facilities of the older lines for dealing with it are immense. The management is energetic. The Manchester service has been gradually quickened up as the banks get well consolidated, the fastest time now being 4 hours 35 minutes over the 206 miles, with three stops. After building no single-driver engines for many years, the Great Central is now turning out some at its Gorton Works, to run between Nottingham and London on the Manchester service. They are to have inside cylinders 19½ x 26, leading bogie, very large and high boilers, and 7 ft. 9 in. drivers. The longest and fastest run is now (February) London to Leicester, 103 miles, in exactly two hours.

The company's relations with the Metropolitan Railway, over whose line it runs for over 40 miles, seem to be a little better, and a good many trains now call at Harrow and Aylesbury, on that line, when required. The alliance with the Great Western, which will enable the Great Central to free itself of the unfriendly little line, is an accomplished fact. In addition, the Great Central have begun a line from Neasden, where their London engine sheds are, to Northolt, on the Acton & Wycombe section now constructing by the Great Western. This route will somewhat increase the distance from London to the large towns by the Great Central route, which is already longer than any of its competitors, but will give better gradients and a free hand in arranging the train services. A connection has also been made at Neasden which will be of great value for coal traffic. It was mainly for the sake of carrying their own coal traffic themselves that the Great Central came to town. Some very good positions for parcels and goods receiving houses have been secured in various parts of London, mostly as near as possible to those of the Great Northern.

The London establishment is now practically complete. The great hotel is in full work and doing well. The London coal yard is full of business, but the connection with the Regent's Canal seems to be doing little. Powers are sought to make several short branches to collieries, etc., and a link to shorten by

seven miles the connection to York, all of which will be of benefit in due time.

As a way out of present difficulties the Directors desire to raise six millions sterling of second debenture stock, at a rate not exceeding, if possible, 3½ per cent. This will enable the Lloyd's bonds to be paid off; also the Railway Rolling Stock Company's debt of a million. In fact, it will pay off the four and a half millions by which the capital account is now over spent, and leave one and a half to carry out many necessary undertakings. With working expenses over 70 per cent. of the receipts and a system which requires rest and time for growth, it is the only thing to be done, but whether the issue will be taken up remains to be seen.

London, S. W., Feb. 28.

Some Questions in Locomotive Design.

[This matter was prepared before the appearance of Mr. McHenry's recent valuable paper on Freight Train Speeds on the Northern Pacific. That paper seems to substantiate the essential opinion advanced by the questions here presented, namely, that the relation between weight on drivers, speed, and horse power is a more important feature than has usually been supposed.]

Certain recent formulas and a diagram that has been frequently referred to in discussions that have appeared in the columns of the Railroad Gazette, suggest some questions concerning locomotive design that are not wholly discussed in the text-books, and the following study is presented to bring out discussion of the questions considered.

It would seem that in order that a locomotive may be symmetrically designed in the matter of tractive power, there should be, if possible, some definite relation between the horse-power to be developed, the speed, and the weight on the drivers, just as there is between the horse-power developed by a stationary engine, speed, and the fly-wheel and belt. Doubtless it is far more difficult to bring about this relation in a locomotive than in a stationary engine, and doubtless the locomotive builders are fully cognizant of the relation in designing their engines. But the diagram already referred to seems to indicate that some improvements may be made in the direction suggested. A further explanation of the diagram may indicate that the first reading of it is not correct. The formulas will be first considered.

Omitting the internal losses, the cylinder tractive force of any locomotive of indicated horse-power, P, at any speed, S, in miles per hour, is given by $T = \frac{375\ P.}{S}$. The portion of the indicated power that is consumed by internal friction is variously estimated at from 5 per cent. to 10 per cent. If 10 per cent. is lost in this way, the coefficient in the formula becomes 337.5. Let a coefficient of 340 be assumed, and let the coefficient of adhesion be taken at one-fourth. Then $T = \frac{340\ P}{S} = \frac{W}{4}$ and $P = \frac{W\ S}{4 \times 340.}$ W is the weight on the drivers. This means that if a tractive force of T pounds be required at S miles an hour, and the coefficient of adhesion may be taken at one-fourth, the locomotive must be capable of developing $\frac{W\ S}{4 \times 340}$ indicated horse-power at the speed S. If the design is for a heavy freight engine to exert its full adhesion at 10 miles an hour, then must $P = \frac{W}{136}$. If T is required to be 34,000 lbs. at 10 miles, then must P = 1,000. If the design is for a fast passenger engine which shall be capable of a tractive effort of 11,333 lbs. at 30 miles an hour, there will be required 45,333 lbs. on the drivers and 1,000 horse-power. To acquire speed quickly from a stop will require a greater weight on drivers than the balance indicated by the formula, and, moreover, it is doubtful if so powerful a locomotive could be built with so little weight on drivers. But the formula is suggestive.

In this connection the diagram of horse-power developed by certain engines on the Northern Pacific Railroad will be of interest. This diagram was presented somewhat incidentally in a paper by Mr. E. M. Herr before the Western Railway Club. Little was said about the diagram, though it seems to be one of the most interesting parts of the paper. The diagram is here reproduced, and from it, and some other data in the paper referred to, a table has been made showing the weights on drivers, total weights, per cent. on drivers, maximum horse-power developed, and the speed at which the tractive force due to this horse-power equals one-fourth the weight on the drivers. This speed, if calculated from the formula already given, will be less than shown in the table and diagram, because the diagram is based on $T = \frac{375\ I.\ H.\ P.}{S}$ no account having been taken of the frictional losses.

Reference letters on curves.	Engine.	Weight on drivers, lbs.	Total weight, lbs.	Weight on drivers, per cent. of capital.	Horse power developed.	Speed at which tractive effort of maximum power equals ¼ weight on drivers, miles per hour.
	Compound:					
F.	D3 Mogul	85,900	104,400	82	660	11.5
B.	P 10-Wh. Pass.	112,000	155,500	72	1,120	14.6
D.	R 10-Wh. Frt.	126,000	172,500	73	1,150	12.4
A.	X Mt. Mast	150,000	186,000	81	1,200	12.0
	Simple:					
G	D3 Mogul Baldwin	85,000	100,000	85	595	10.5
E.	F1 Mt. Cons	135,000	150,000	90	840	9.3
C.	P 10-Wh. Pass.	110,000	148,000	74	1,075	11.5

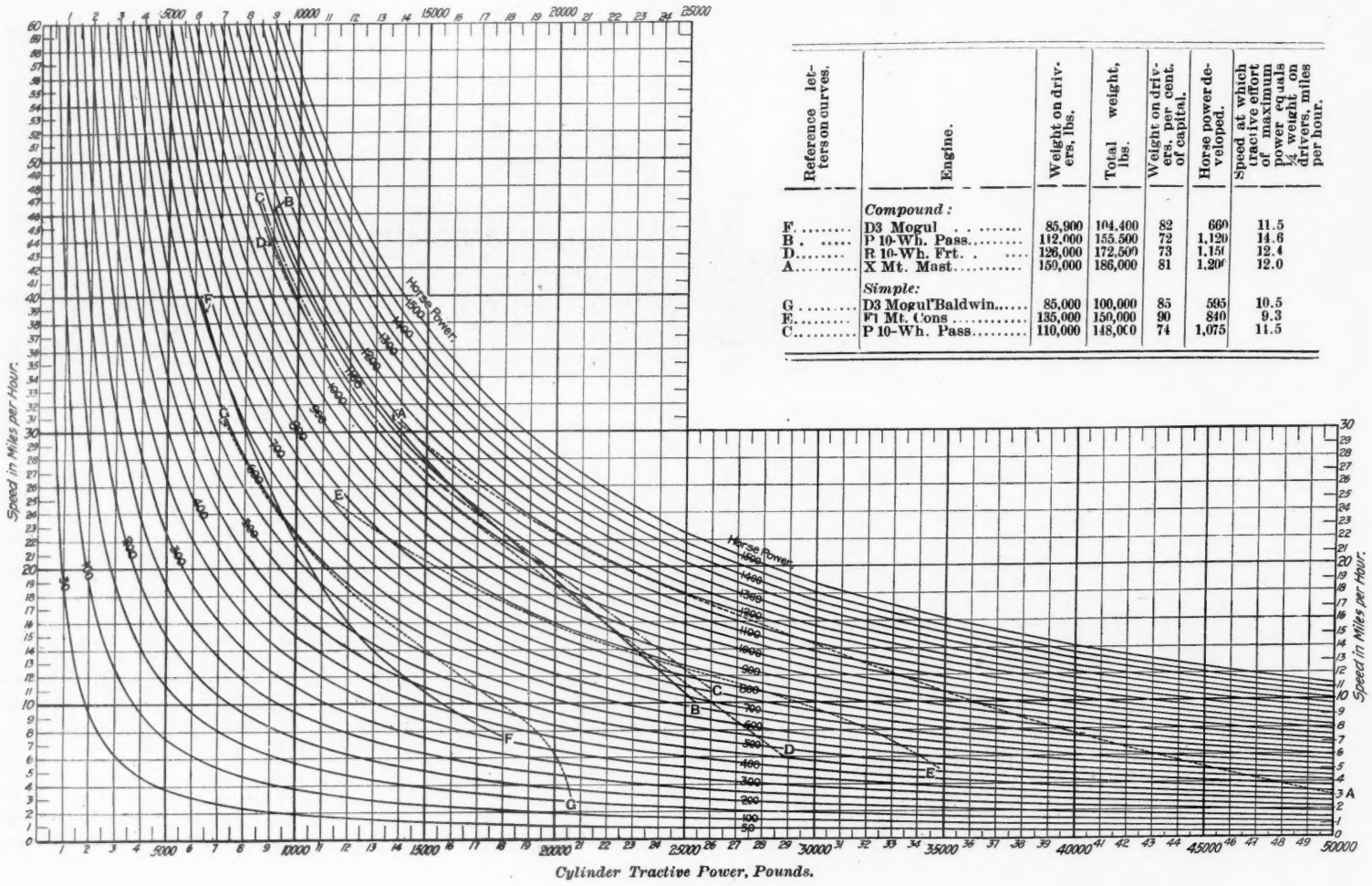


Diagram of Locomotive Horse Power Curves.

A reference to the diagram will show that the tractive force, one-fourth the weight on drivers, was in no instance obtained at the theoretical speed. The engines show a power development falling rapidly as the speed is reduced. This is perhaps most marked in the compound D3 Mogul and class P and R engines. None of these engines realized a traction of one-fourth the weight on the drivers at any speed shown, and the compounds seem to fall farther short than the simples. In the discussion of Mr. Herr's paper, Prof. Smart called attention to the fact that the locomotive power lines fall below the hyperbolic theoretic lines at low speed and expressed surprise that the efficiency of the boiler should be thus shown to be least at low speed. The matter was explained by Mr. Herr by the statement that at the low velocities trouble was experienced with slipping drivers. It seems surprising that this can explain the very early departure of the power lines from the lines of constant power. Is it possible that the drivers of the class P and R engines began to slip at 23 to 25 miles an hour when the indicated tractive force was less than one-fifth the weight on the drivers and the actual tractive force considerably less than this? In the case of the D3 compound the slipping must have begun at 30 miles. Did the drivers of the compound mastodon begin to slip at a little less than 20 miles and yet permit a reduction of speed down to 2 or 3 miles with a tractive force of one-third the weight on the drivers? It seems incredible, but perhaps it is possible.

Is it not more probable that the engines were unable to develop their maximum power at the lower speeds, and that the class P and R and the D3 compound were most faulty in this respect? It seems to be shown that at some particular speed an engine will develop its maximum power; that this speed depends on the design of the engine; that a small variation of speed either side of that for maximum power will not materially affect the development of power; but considerable variations either way will materially lessen the possible development; that the rapidity of falling off depends on the design of the engine.

Consider the diagram for class X engine; the engine should develop its full tractive force of adhesion, one-fourth the weight on the drivers, at 12 miles an hour; it does develop this at 9 miles, 25 per cent. less than the theoretic speed, and it is thus less because the power developed is only 75 per cent. of that developed at 20 miles an hour.

Consider class P compound; it should show its full tractive force of adhesion at nearly 15 miles. The diagram does not extend far enough to show that the full force was ever realized, and the indication is that it could not be realized at a speed in excess of six miles an hour. The power developed at this speed would be about 450 horse-power, or only about 40 per cent. of that developed at 30 miles an hour. Class P simple shows better only by comparison; it should develop its full force at a little less than 15 miles, while its line continued indicates that it may develop this force at about nine miles an hour, with a power about 62 per cent. of the maximum.

Consider similarly D3 compound, which should show its maximum tractive force at something over 11 miles; its maximum force was never realized, and at eight miles it shows only 56 per cent. of the power developed at 35 miles and over. The simple D3 locomotive does very much better in this respect than the compound. The F1 simple falls off, as do the others, but less early, and the curve changes so abruptly for this engine and the D3 simple as to suggest difficulty with slipping drivers, or with the D3, too light load to demand full power or traction. Indeed, this same explanation might be offered for

the P and R engines had Mr. Herr not intimated that he thinks the lines show about what the engines can do.

This study of the diagram leads to the following questions:

1. Why do the actual power lines fall below the hyperbolic lines as the speed is reduced? Is it possible that this is sufficiently accounted for by the slipping of drivers? It must certainly be noticed that the locomotives having the greatest per cent. of weight on drivers show best, but it is not true that those having the greatest absolute weight on drivers make the best showing.

2. If slipping drivers is the sole explanation of the fact noted, is not 1/5 a better traction coefficient than ¼ or 1/4.25?

3. Assuming that slipping drivers do not sufficiently explain the observed fact, is it because of the detail of design of the locomotive; and may not the engine be designed to secure economically the maximum power at some definite speed?

4. If this is so, then, in view of the growing desire for more traction and less speed in freight service, will it not be best to design freight engines for slow speed?

5. As this would probably mean cylinders of large diameter, how far is it practically possible to go in this direction? The line of the class F1 simple engine indicates that something better can be done than has been done in the P, R and D3 compound engines. And it is to be noted that F1 has the largest cylinders of any of the engines except X.

6. Do not the simple engines, weight for weight, show greater tractive force at slow speed than the compounds?

7. Granting this, will the reduced cost per ton-mile shown in Mr. Herr's paper for the compound engines offset the reduction in train-miles that can be effected by the greater traction of the simple engines?

It is true that the weight of train hauled is considered in computing the cost per ton-mile, but the trains behind the simple engines were uniformly of less weight than those behind the compound engines. If the diagram is right in showing greater tractive force for the simple engines at ordinary freight train speeds, why did these engines haul lighter trains?

There is no intention to criticise the use of compound engines for locomotive service; such engines are theoretically more economical than simple engines, and when they have been properly designed should show favorable results; but the diagram has been insufficiently explained, or the particular engines shown did not develop as great tractive effort, and should not have hauled as great trains as the corresponding simple engines. It is suspected that the diagram shows what the engines do under usual operating conditions rather than what they can do; that it shows the relation between cylinder tractive force and speed under usual running conditions, and with usual running loads, rather than the actual general relation between speed and tractive effort even for these particular engines. The fact that some engines never reached what may be supposed to be the limit of adhesion suggests this suspicion, though the performance of the X engine is against it, and Mr. Herr's statement that the curves represent about what the engines can do is against it.

8. Is the formula already given, when modified as follows, a rational basis for locomotive design?

For freight service and slow passenger service on mountain grades: Horse-power $= \frac{S\,W}{4 \times 340}$ or Horse-power $= \frac{S\,W}{5 \times 340.}$ For fast passenger service, Horse-power $= \frac{TS}{340}$, W to be as small as practically possible.

9. Is the proper investigation leading to a rational order for a freight locomotive somewhat as follows? Determine the load to be hauled on the ruling grade and the minimum speed; determine from this the weight on drivers, and from the formulas of this discussion the corresponding horse-power; note that both are practicable quantities (or begin with a practicable weight on drivers and determine the load and power); with a profile of the division on which the engine is to work, determine at what speeds the various grades can be worked with the given load and power; do this for both directions with the proper load for each; thus determine the probable average schedule speed, and order the locomotive of the required weight on drivers, the required horse-power to be developed most economically at the determined average speed. There are other details, to be sure, but should the foregoing be the basis of design?

10. Is the present practice in locomotive design based on essentially these considerations?

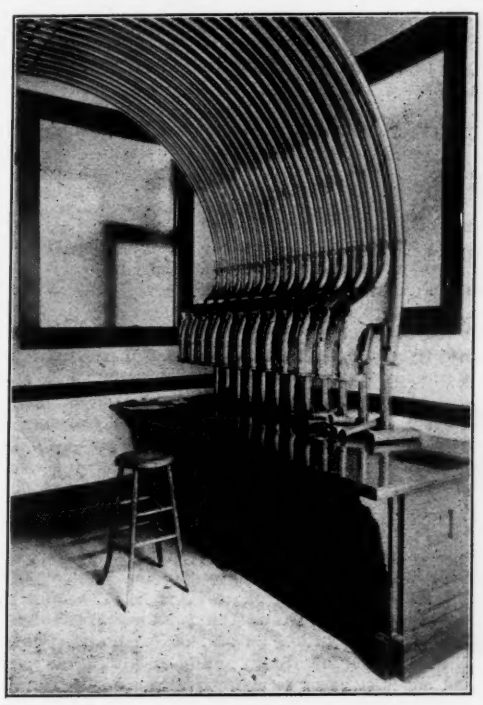
WM. G. RAYMOND.

The New Office Building of the Westinghouse Electric Co.

In 1894 the Westinghouse Electric & Manufacturing Company removed from the city of Pittsburgh to East Pittsburgh. New works were erected and buildings were so designed that future extensions could easily be made. Last year the works again proved unequal to the demand and recent additions already completed, and those now in progress, will bring the floor space to 11½ acres. About a year ago it was determined to build permanent offices of sufficient size. The architectural features and the general arrangement have been under the direct supervision of Mr. George Westinghouse. The building just completed is 250 ft. x 50 ft. with seven stories. The entire building is fireproof. The floors and partitions are of terra cotta. The roof has a very high pitch, and is of steel trusses with iron purlins and slate.

The total number of employes at the company's works at East Pittsburgh is close upon 5,500, requiring several special trains, each of twelve cars, for their conveyance to and from the works. A covered way leads from the station to the new offices.

A novel feature has been introduced by devoting one entire end of the building to fireproof vaults. Twenty-four feet from the outer wall a fireproof brick wall is carried upward from the foundation to the roof, forming fireproof vaults upon the several



Pneumatic Station in the Westinghouse Offices.

floors, each having an area of 1,200 sq. ft. Entrance to these six vaults is through two sets of double fireproof iron doors on each floor.

The entire fourth floor is occupied by the Mechanical Engineering Department, and by the draughtsmen. The fifth floor is similar to the fourth and the electrical engineers are housed on this floor. On the sixth floor are two dining rooms. Adjoining them is a kitchen with butler's pantry. One of the rooms of this floor forms the "Central" for the telephonic system and another serves as a dining room for the female stenographers.

The ventilation of the building has had great care. Upon the sixth floor under the roof is a large horizontal ventilating shaft running from end to end of the building, flues connecting each room with the main shaft. An electric motor operates a Sturtevant fan in the center of the main shaft, which, during the winter, expels the vitiated air, driving it above the roof. Fresh air is admitted into the offices by a part of the heating system, passing through shafts in the wall behind radiators, which heat the air as it is admitted.

The two passenger elevators were supplied by the Crane Elevator Company. They have a travelling distance of 73 ft. from the ground to the sixth floor, each one being rated to carry 1,500 pounds at 400 ft. a minute. They are operated upon the electro-hydraulic system, the mechanical plant being upon the ground floor. The hydraulic apparatus includes two large water tanks, one of them containing water under pressure. The Westinghouse type "C" motors operate pumps which force the water from the low-pressure to the high-pressure tank. As soon as the pressure is reduced to 100 pounds, by using the elevators, a weight falls which automatically closes the switches, and the electric motors commence to drive the pumps until the pressure in the tank is raised to 140 pounds, when the switches open automatically and the motors stop. As the water leaves the high-pressure tank it returns to the other one.

Probably the most novel feature is the system of pneumatic tubes whereby all works departments and all of the offices are connected through a central exchange station. The central station of the pneumatic system contains twelve sending and receiving tubes, furnishing service to all floors of the office building and to important points in the works. The tubes are of 2¼ in. brass, the longest line being 3,500 ft., the circuit of which can be made in from 40 to 45 seconds, or at a speed of about a mile a minute. The system is operated by a positive exhauster of the Connellsville type, which, exhausting the air from the tubes, allows an inrush which propels the carrier to its destination, where it is discharged through an air valve which immediately closes, forming the circuit back to the starting point. The pressure or vacuum maintained is about 24 ounces, which is capable of handling a carrier and load equal to 8 lbs. at the speed mentioned above. All the mail and other matter is thus distributed.

Purchasing Under Specifications.*

The value of materials and supplies purchased annually by the railroad forms a goodly proportion of the cost of yearly operation. The first cost of any article is not the sole basis of that article's value. Price is but one component part in the determination of values, but care needs to be exercised in the preparation of specifications covering that which is to be purchased, that they are not so worded as to cut out legitimate competition. To make requisitions call for so many boiler tubes of some particular copyrighted brand or for so many pieces of boiler plate of some special manufacture, etc., is not to provide your buyer with specifications, but tends only to annul the sole intent and purpose of the office of purchasing agent.

We will agree, as a general proposition, that a person who makes a specialty of manufacturing any one thing will be better posted regarding the details of that particular business, than one whose time is necessarily divided between a great variety of subjects other than materials and supplies; and of most articles used by railroads there are several reputable concerns engaged in the production of each line of goods. Specifications are sometimes so worded that the manufacturer is told just how he must make the article desired, and then told the particular results that he must guarantee that particular article to yield the purchasing company. The writer believes in specifications, but not in hobbies, and there is nothing purchased but what, speaking generally, should be bought under specifications. But the specfications should be such as to clearly place before the several manufacturers the result to be accomplished, and the accomplishment of which it is your intent to hold them accountable, rather than to have the specifications so drawn that the purchase price is the principal thing affected, and that in an upward direction. It is either the misfortune or good fortune of the writer to have had several years' experience, both as a purchaser and a seller, and in the latter capacity he has frequently "gone up against" a phase of the "specification argument" that is quite familiar; where the specifications were so worded that his bid could not be entertained because his articles did not have quite the proper ingredients in quite the proper proportion.

One of our members not long ago very courteously referred to a letter upon the question of the specifications for air brake hose used upon the line with which the writer is connected—and more or less discussion followed in one of the railroad papers. The writer's experience from that date to this fully justifies the position he assumed in those discussions, and he still continues to purchase air brake hose upon the broad specifications of a guaranteed service. Experience has taught the requirements of a hose capable of resisting a specified pressure, and that in average service should yield certain reults; what more do you want of a reputable manufacturer than his guarantee of that result in service? Broadly speaking, this should be the sole aim of all specifications, namely, guaranteed service. Let the several heads of departments recognize the fact that, as they are unquestionably much better fitted to have charge of the work assigned to them, so is it possible that the man doing the buying may perhaps be a better trader than they, and the better fitted for his particular duties. Mix these two good things together and so get the full capacity of both—and don't handicap your buyer with specifications that some interested person may have helped suggest. Specifications can always be so drawn that they will secure the service desired, and, at the same time, not shut out competition from any reputable manufacturer, and, therefore, secure to the road the one result that should always be sought, viz., the best value for one dollar.

Buying is fully as much an art as is any other branch of the railroad service, and the buyer should be selected with reference to his fitness for the place, and, as before stated, the several officials and subordinates must unite in increasing the sum placed annually to the credit of profit and loss account. No branch of the railroad offers a better field for saving than that which can be accomplished by taking the buyer into confidence in all departments of the service, secure his co-operation in the preparation of all specifications and, subsequently, keep him fully advised as to the practical results obtained from using the things bought. While not entirely germane to the subject, the writer begs to suggest that it will be economical if the heads of the several departments will consult freely with the purchasing agent in the matter of ordering various articles for trial purposes, and provide for the purchasing agent making the necessary purchase order for the articles for trial, and so arrange that all reports with regard to the performance of the trial material shall be issued through the purchasing agent's office. It is far from the speaker's desire to undertake to create the impression that the purchasing agent's office is the one central pivot around which the entire railroad organization rotates, but from past experiences gathered from a rather active experience both as a seller and a buyer the

*Extracts from a paper by Mr. Ira C. Hubbell, Purchasing Agent of the Kansas City, Pittsburgh & Gulf, presented before the Western Railway Club, March 20.

writer is confident that the observance of the spirit of what has been said will conduce to a material reduction in the operating expenses of a road.

Discussion.

Mr. G. G. Yeomans, Purchasing Agent, Chicago, Burlington & Quincy: Among the fundamental rules, laid down by the President of a certain railroad, which I once had an opportunity to examine, was the following: "Requisitions must not be made for special brands or manufacture of supplies or materials, but may call for material to stand certain tests or requirements which shall, whenever practicable, be in accordance with such standard specifications as may have been adopted by the Company." This rule reaches the very root of the correct theory of railroad purchasing, and, in my judgment, should form a part of the code of every well-organized railroad. It makes purchasing under specifications one of the cardinal features of the service.

The refuge of the purchasing agent is the specification. If the specifications themselves rest on the broad basis of common sense and are modeled on the lines of actual service, experience and mechanical practicability, his position is impregnable. This brings us naturally to the framing of the specifications under which the purchasing agent is to act. They must necessarily be drawn by the experts in charge of the mechanical or engineering departments, but even here the commercial training of the purchasing agent may be made useful to a certain extent in an advisory way. If he has been selected with special reference to his fitness for the position, he should have at least a good general idea of the methods employed in the manufacture of all the most important kinds of material which he buys, and especially of those mechanical limitations which have a direct bearing on the cost of production. The first aspect in which any given question presents itself to a buyer is that of cost, while at times this may be temporarily lost sight of by the expert intent only on the results to be accomplished. Besides this, if the purchasing agent is consulted when the specifications are being prepared, he becomes aware of the exact results aimed at, the reason why certain requirements are considered necessary to such results, and is enabled to act more intelligently in his subsequent dealings with the manufacturers.

Among the numerous specifications for material that continually come to my notice, there is here and there one which indicates a tendency to dictate the methods by which certain results are to be accomplished. This tendency should be avoided. A specification should attempt only one thing, namely, to point out to the manufacturer the qualities desired in the material, and the means which will be employed to ascertain the presence or absence of those qualities, leaving him free to produce them in his own way and holding him responsible for results by rejecting any inferior material that may be offered. It is here that the well-equipped chemical and physical laboratory comes into play as a vital part of the system of purchasing under specifications. Without its efficient aid the whole scheme is practically inoperative.

While it is well enough in one sense to purchase material subject to a guaranteed service, there are numerous objections to the application of such a principle in its literal sense. The chemical and physical tests may be said to represent approximately the requirements of service. Indeed, that is their object and their function, and in these days we cannot await the verdict of actual trial except in cases of unusual importance, or where time is not an object. The laboratory reports should be the purchasing agent's professional bible. By them he is able to judge which of the various makes of similar material is most uniformly of good quality, and often to decide without hesitation between two or more similar articles which are offered at the same price. They should form as necessary a part of his records as the invoices for the material which he buys, and should be his vouchers for the quality of the materials which he has purchased under specifications.

I am heartily in sympathy with the idea that the purchasing department should not be considered as a separate and distinct institution, but rather as a co-operative branch of each of the three great departments to which the operation of the modern railroad is entrusted; and that the purchasing agent should be, ex-officio, a member of each of them, as an expert in his particular line.

Mr. R. H. Soule: One of Mr. Hubbell's conclusions, it seems to me, is susceptible of some discussion. I refer to the paragraph which starts in by saying: "Broadly speaking, this should be the sole aim of all specifications, namely, guaranteed service."

In my experience I have found in some instances that it is very difficult in practice to follow up the service guaranteed, and therefore I am of the opinion that the usefulness of a service guarantee should also be measured by the feasibility of applying it successfully in the service. To illustrate the point, I will refer to the fact that it is very difficult and almost impracticable to follow up a service guarantee for spiral springs, such as are used in draft gear and trucks of freight cars. Similarly, it is difficult and almost impracticable to follow up a service guarantee for such things as boiler and firebox plates, or for staybolts, whereas, on the other hand, it is practicable to follow up a service guarantee, either in time or mileage for such things as elliptical springs or semicircular springs as used under locomotives or passenger cars.

Therefore, it seems to me that that statement ought to be modified so that it would read that the sole aim of all specifications should be either guarantee of service or guarantee of qualities, because where you cannot follow up a service guarantee, the only recourse you have left is to draw up the specifications in such manner and specify and apply such test to the articles when purchased that you are sure that the articles are conforming to the specifications and that you are getting the thing which is best for the purpose.

Mr. I. C. Hubbell: Referring to that portion of the paper pointed out by Mr. Soule, the language implied in that statement hardly conveys the meaning that I had intended. I have not meant to decry specifications as developed in the remark of Mr. Yeomans. I believe in specifications, and I think I have stated that fact, but I am everlastingly against hobbies, because in my experience I have seen just exactly how they lead to the wrong results.

The Work of Railroad Men on the Problem of Pure Water for Steam Boilers.

By C. Herschel Koyl.

II.—The Remedy.

In my first paper I endeavored to give a brief summary of the extended and wonderfully practical work of the American Railway Master Mechanics' Association in gathering statistics concerning the effect of the use of hard or impure water in locomotives; how it causes an average increase in the coal bill of something like $340 per locomotive per year; an average increase in boiler repairs of something like $360 per locomotive per year; and an average increase in boiler cleaning of something like $50 per locomotive per year; or a total expense of $750 per locomotive per year, due alone to the use of hard or impure water.

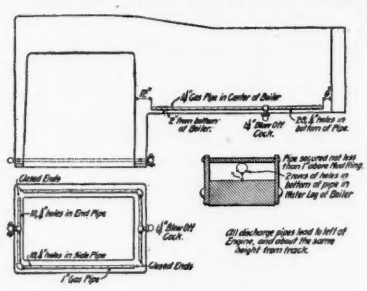
It is one thing to gather statistics; it is another to make proper use of them. The public service and many private corporations are filled with men who can gather statistics of troubles by the mile. A few of these men realize the necessity of arranging such statistics into sets, and so combining the essentials and eliminating the non-essentials that general conclusions of force and value, concise and accurate like the above, may be drawn. A lesser number is able, not merely to gather statistics of trouble and damage and to formulate them properly; but also to take the next step and propose the remedy, this remedy being the real object of the investigation and all its statistics. The selection of the proper remedy is as much a matter of elimination of non-essentials and half-way measures as was the general conclusion from the mass of statistics, and the ability to select a general remedy covering all cases is no less a mark of genius than the ability to find the one cause of all the trouble.

Happy is the Association containing men of calibre for such occasions, happy if it succeeds in selecting such leaders from its many willing members. All of these circumstances combine in the fortunate work of the American Railway Master Mechanics' Association. When the question came up of a remedy for the ills of hard and dirty water, one member proposed better methods for washing out the boilers; another proposed improved processes for getting the hard scale off the tubes; another proposed boiler compounds to precipitate the scale-forming matter into the bottom of the boiler; another spoke of some electric device for doing the same thing; an almost endless diversity of cures was proposed by different members. But the Committee, happily the right men in the right place, said from the first: "Try not merely to lessen the evils, but try to prevent them. The only way to prevent incrustation and corrosion is to purify the water before it enters the boiler, and the accomplishment of this result will be the 'ne plus ultra' of this important subject."

This proposition met with ready acceptance in the Association after it was clearly understood, and fortunately the leaders in the work were able to bring to their assistance the technical knowledge and skill and the counsel of Professor Joseph A. Sewall of the Illinois State University, who joined the Committee in insisting that the only wise and scientific method of preventing the damage of impure water is to purify the water before it enters the boiler, and that all other cures proposed were simply makeshifts to be used only while the true solution of the problem was being sought.

Though the Committee realized thus early that what they wanted for locomotives was clean, soft water, yet they realized also that the problem of securing it was difficult and would require years of study and work, and they therefore, as a preliminary, set about ameliorating the conditions in the boilers by developing better methods for blowing out soft sediment under working pressure, while the locomotive is in service, and by making a study of boiler chemicals to learn which ones might for the time be used with safety for precipitating the scale-forming matter within the boiler.

As I am endeavoring to summarize the work of many years, I reproduce here an illustration of the boiler blow-off arrangements used on the New York, Chicago & St. Louis, shown in a late report of the Master Mechanics' Association. They seem to me to embody the best ideas on the subject, and, since no water is absolutely free from suspended matter, it would be well if every locomotive and every stationary boiler were supplied with such an apparatus.


4" Gas Pipe in Center of Boiler
2" from bottom of Boiler.
4" Blow Off Cock.
20-3/4" holes in bottom of Pipe.
Pipe secured not less than 1 Foot from Fire Box Plate.
2 rows of holes in bottom of pipe in Water Leg of Boiler.
Closed Ends
12-3/4" holes in End Pipe
12-3/4" holes in Side Pipe
4" Blow Off Cock.
All discharge pipes lead to left of Engine, and about the same length from track.
Closed Ends
4" Gas Pipe

The discussions of the Committee upon the subject of boiler chemicals may be summarized as follows: If the boiler water contains scale-forming material and efficient boiler precipitants are used, there will be in the boiler as much foreign matter as before and in addition whatever is left by the boiler chemical, yet this matter will not be hard scale, but a soft mush which may be taken out of the boiler with less trouble and expense than hard scale. Of the thousand and one boiler compounds in the market most are useless, and of the balance most are dangerous because of their corrosive action upon the iron; and there are left only a few, all compounds of soda, which have any efficacy and at the same time are not dangerous. A comprehensive set of tests has been carried on in reference to the efficiency of these soda salts as boiler precipitants, and the Committee finds that by their use the boiler repair bill has been reduced, showing the good effect of keeping the flues free from scale. It is said that on one road the boiler repair account shows a reduction of $75,000 per year, and one road reports that the effect of keeping the tubes free from scale and corrosion has been to increase the life of the tubes from 50,000 miles to 150,000 miles. Therefore, if soft water could not be procured at some reasonable expense, it would be advisable to use soda ash or something similar for the purpose of precipitating the scale-forming matter within the boiler in a sludge which may be blown out.

But there is little said about the saving in fuel, and it is evident that even the best of boiler precipitants are not good in this respect; because, first, while the scale-forming matter is precipitated from the water, it yet is precipitated within the boiler, so that it has the same effect as any other foreign matter lying in the bottom of the boiler, and prevents the access of heat to the water; because, second, this foreign matter in the bottom of the boiler requires frequent blowing out under pressure and while the locomotive is at work, with consequent loss of much hot water; because, third, when soda ash or any equivalent is fed to a boiler for precipitating purposes there is apt to be much foaming when the locomotive is climbing hills.

Returning now to the real problem of the Association, it is clear from the work of the Committee that since the average total cost of the impurities in feed water is about $750 per locomotive per year, and since a locomotive uses about 1,500,000 gallons of water per year, the cost of impurities in feed-water is not less than fifty cents per 1,000 gallons, and that therefore any process or method by which water free from these impurities can be delivered to the locomotive at a less expense than fifty cents per 1,000 gallons will be an advantageous arrangement.

The first recommendation was "Get, if possible, a supply of clean, soft, natural water." And it is evident that a capital expenditure for this purpose would be profitable just in so far as its interest at, say, 5 per cent. per annum would make a sum total of less than fifty cents per 1,000 gallons of water thus supplied. For instance, if at a station requiring 100,000 gallons per day of twenty-four hours, it were possible to provide that amount of perfectly satisfactory boiler water for an initial expense of $73,000, the yearly interest on which at 5 per cent. would be $3,650, the water supply at that station would cost ten cents per 1,000 gallons, and this would be a saving of four-fifths of the present cost of water and would therefore be a profitable investment and one to be recommended to any railroad, no matter how rich or how poor, and for any and all points on that road where good water was not otherwise procurable. The plans for water sheds and reservoirs it is not necessary to reproduce.

A second possible means of getting soft water is the distillation of hard waters by stationary boilers in the vicinity of water tanks; but the Committee

shows that the expense of such distillation under the most favorable circumstances is not less than thirty-six cents per 1,000 gallons, in addition to the expense of cleaning the scale out of the stationary evaporators, and therefore thinks that the plan is not feasible for any but the most extreme cases.

A third possible means of getting pure water, discussed at great length by the Association and by the scientific men called to its assistance, is that of purifying the water before use, by chemical precipitation of its impurities. This was found to be entirely possible, but at that time the state of chemical and mechanical knowledge as applied to industrial work of this character was so crude that the Association hesitated to recommend for general use any plan known at the time, and decided to await greater development in this promising field. But the impetus given by the Association to efforts in this direction has proved most beneficial and it is now possible to get satisfactory boiler water out of almost any kind of raw water, be it hard, muddy or foaming.

In a third paper I shall endeavor to show the present state of the art of converting hard waters into soft water, muddy waters into clear, and alkaline waters into neutral, and to prove that the locomotives of the country can now by this means be supplied with satisfactory water at less price than similar water can be purchased from cities or provided in any other manner.

Applications of Compressed Air in Railroad Shop Practice.*

BY EDWARD C. SCHMIDT.†

Wherever steam has gone to create the necessity and opportunity for it, there compressed air has followed, going often where steam could not go, rivalled only in its adaptability and convenience by electricity. In all branches of industry and manufacture it has its hundreds of applications, and this is no mere figure of speech, for there lies before me a list of nearly four hundred different uses of compressed air, and this list is doubtless incomplete. . . .

In case of transmission and of application, in adaptability, as well as in cost of installation and maintenance, air and electricity are on almost equal footing, and it is only when we consider the tools by which this power is applied that we find the advantages of the former over the latter. It is in the greater simplicity of the motors required for its local application that air may base its claim to distinction. In addition to the important difference in cost, due to the greater simplicity of construction, the air-driven tool possesses the advantage, so requisite for its proper use, of being readily understood by the operator—a claim which cannot be made for electricity for some time to come, for the confusion and dread, in the ordinary mechanic's mind, of all things electrical, are not soon dispelled.

The figures relating to saving in time and labor as given in this paper were, without exception, obtained from the master mechanics or general foremen, and in almost every case these estimates were verified by consultation with the shop foremen and the operators themselves. Care has been taken to ensure that such figures represent ordinary conditions, and records made particularly for the purpose of showing a saving, or under unusually favorable circumstances, have been excluded or modified, so that the figures given may with reason be relied upon for the conditions mentioned and under which they were obtained. In one of the railroad shops, and one from which more than its share of this information has been drawn, the change from hand-work to the use of air tools has been made within the last 18 months, and many of the figures are derived from daily records, and all the information is fresh in the minds of those concerned. In all other cases where the figures given were not based on written records, the results, as intimated above, have been carfully scrutinized.

For riveting, the use of the pneumatic holder on adds much to the tightness of the work. In one of the shops visited, in riveting the mud ring on a consolidation locomotive by the air hammer, the saving over riveting by hand was 67 per cent., and this class of work is typical of much of that done by the hammer.

One of the most interesting operations performed by the pneumatic hammer is the chipping of wrought iron and steel. In one instance, in work of this character, done on a "ten-wheeler," the work formerly requiring the labor of a boiler-maker and helper for two days is now done in one-quarter of that time.

In a particular piece of work on saddles, typical of many situations in which the pneumatic drill is used, a machinist and helper accomplished in three hours what would have required by means of the ratchet drill 16 hours, and this saving of 70 per cent. is by no means extraordinary. . . . In one of our Chicago boiler shops the time required for work done by the pneumatic breast drill was to the time consumed on the same work when done by the hand-driven tool, in the ratio of one to ten or one to twelve. The various other uses to which the motors of all these air drills may be put present themselves at once, and by one of these applications—the grinding and facing of steam pipes—there is now accomplished in 15 minutes what formerly, by tedious hand work, took an hour or more.

The facility with which compressed air may be made to meet particular needs has created in many shops, in addition to the regular pneumatic tools, a number of special devices, one of which is a press for the brasses of driving boxes. This machine drives the brasses for all the boxes that go through the busiest shop on one of the largest railroads in the West. With it two men and a helper now do all the work formerly done by eight men, and it has become as indispensable to its owners as the lathe beside which it works.

For chipping out defective stays on an ordinary American type locomotive, which had come into the shop with about the usual number to be replaced, three hours' work by an apprentice boy sufficed to do the cutting-out which it would otherwise have taken a boiler maker an entire day to do. In this case the boy can undertake, without risk of damaging the plate, work which would not ordinarily have been entrusted to him with the hammer and chisel. . . . The hammer used for flue beading effects about the same saving as it does in other classes of work. To bead 250 flues by hand cost $2.35, while the same work done with the aid of air amounted to 60 cents.

The portable riveting machine with fixed yokes can, of course, do better work than the hand hammer, and for a great variety of work will produce as good results as the stationary pneumatic riveter, besides being much more convenient. "With these riveters," to quote the foreman of one of the boiler shops referred to above, "we can do with three men (two boiler makers and one helper) twice the amount of work formerly done by three boiler makers and one helper riveting by hand." These machines will operate successfully on plates up to about seven-eighths inch in thickness, and for work of this class will compete in their results with hydraulic riveting. Indeed, the foreman in the same shop informed me with considerable satisfaction that work done by one of these riveters had been inspected and passed as hydraulic riveted, a few days previous, by an inspector of one of our best known boiler inspection companies, who was with difficulty convinced of his mistake.

One type of air-operated nippers cut off in one case all the stays in the firebox of a Brooks "ten-wheeler" in three hours where handled by two boys, a job which formerly occupied a boiler maker and helper nearly two days. This is a saving in cost of about 90 per cent., and the same work with this tool in another erecting shop results in a saving of 86 per cent. The nippers, cutting off from both sides at once, do not injure the sheet or loosen the thread, as may be done by chipping them off. . . .

Passing now to the car shops, we may note the drill again at work, this time on wood—a drill, of course, adapted to this purpose, running at a higher speed than the metal drill and weighing usually not more than 12 or 15 pounds. One of these tools has a record of boring through 5 inches of oak a 2½-inch hole in less than 20 seconds—a statement which is particularly significant to any one who has ever tried to bore a 2½-inch hole in oak. This drill, in the car shop and in rip-rap work, produces a saving of time even greater than that effected by the drill in machine shop operations.

The saving to be effected by the paint sprayer varies, of course, with the character of the work. In general, the larger the area to be covered, the greater the economy in the use of the sprayer; although the intricacy of the work modifies this. The saving in painting trucks is about 85 per cent., while in the case of box car painting, the records kept for several days show a decrease in cost of 90 per cent. . . . The paint burner is a compressed air and oil jet, and by its use four men have been found to do in 10 hours what would, by other methods, usually require 2½ days. . . . In one shop inspected, two boys were doing in 10 hours with a sand blast what formerly occupied two men five or six days, and this saving of 80 per cent. does not represent the total economy; for by the sand blast the paint and rust are so thoroughly removed from even the smallest pit that the new paint lasts much longer and the tank is in the paint shop less frequently than when merely scraped. This same machine is used for sanding the roofs and ends of cars.

The car-journal turner illustrates very forcibly one of the fundamental reasons for the general success of pneumatic tools, namely, the ability of local application and the avoidance of outlay of time and labor in transporting the work to the tool. We have here a machine shop operation transferred out of doors and a car journal being turned in nearly its original position. This tool takes two cuts and a finishing cut on a car axle in about an hour. The ordinary drill is its motor, which is detachable, and consequently available for other work.

The pneumatic fire kindler is an important piece of apparatus in the round house. It is simply a compressed-air oil burner of the simplest construction, but of a usefulness entirely out of proportion to its simplicity. It is used above the coal and without any kindling material. Some of the results of tests conducted by the mechanical engineering department of the University of Illinois with this instrument may be of interest. The tests were made to determine the relative costs of kindling fires by wood and by crude petroleum, the latter being burned by means of a fire kindler. The boiler pressure raised in each case was the same; the time required to reach this pressure was one hour and 10 minutes kindling by oil, and one hour and 44 minutes kindling by wood. The total cost, which in each case includes cost of labor, coal and the kindling material, amounts to 34 cents for oil and 61 cents for wood, on a basis of oil at 2¼ cents per gallon and coal 75 cents per ton—a gain in favor of the oil of about 45 per cent.

In the tables below are the averages of all the figures given in the foregoing. The conditions they represent are normal and such as exist in all shops. All extraordinary records or test cases have been excluded and the results given may safely be applied in making deductions for conditionh similar to those noted in the table.

Tool and General Character of Work.	SAVING. Per cent. of cost.	Per cent. of time.
Pneumatic hammer, general foundry work—chipping	67 to 75	67 to 75
Pneumatic hammer, riveting on mud ring and on firebox	67	..
Pneumatic hammer, chipping flue sheet	84	75
Pneumatic hammer, beading flues	75	75
" " general boiler shop work	60	..
Pneumatic hammer, cutting out broken firebox stays	70	70
Pneumatic hammer, cutting off staybolt heads	58	..
Riveter, boiler riveting	66	50
Drill, drilling saddles	70	70
Drill, in general machine shop work	75	75
" drilling for stays	50	50
" in general boiler shop work	75	75
" facing steam pipes	75	75
" tapping for stays	65	..
" reaming crown sheet	70	..
Breast drill, general work	90	90
Staybolt nippers, cutting off stays	73 to 90	75 to 90
Driving-box press, pressing brasses	68	..
Paint sprayer, painting box cars	67	67
Paint sprayer, painting car trucks	87	87
Paint burner, cleaning off passenger cars	67	67
Sand blast, cleaning tanks	90	83
Air jet, cleaning cushions	50	50

I have confined my attention to the saving effected by the tools themselves, without regard to the outlay at the compressor, but the question naturally suggests itself: What does it cost to compress the air? This is a question easily enough answered in specific cases, but which must necessarily be differently answered in every case. In one shop, from which many of these figures were drawn, the decrease in the saving effected by the tools themselves, due to consideration of the cost of compression amounts to about 15 per cent. at the most, which still leaves a net saving of from 50 per cent. to 60 per cent. These figures must be taken as representing only this one case, and further generalization would be fruitless. That the cost of compression, combined with the interest on the cost of installations and maintenance, would be prohibitive of the use of pneumatic tools in some cases, is entirely conceivable; but that this should be true in a railroad shop of any considerable size is hardly credible.

Among the various men who have supplied the foregoing information, the most enthusiastic advocate of compressed air was the general foreman of a plant where 1,800 cu. ft. of air are used per minute, and where almost every one of the devices mentioned in this paper is in daily operation. It can no longer be said that the use of compressed air is in its infancy, nor can the old charges of unreliability and uncertainty in its action and of great wastefulness in its transmission be substantiated. The use of compressed air in shops is no longer a subject of controversy. The field is already fairly well occupied, and the possibilities are pretty clearly understood.

*Some extracts from an address (illustrated by the stereopticon) before the St. Louis Railway Club, Feb. 9, 1900.

†Instructor in Railroad Mechanical Engineering, University of Illinois.

Technical Schools and the Railroads.

At the December meeting of the St. Louis Railway Club, Prof. L. P. Breckenridge presented a paper on the relations between technical schools and railroads. Considerable was said about the origin of the prominent technical schools of this country, what they are now doing, the capital invested in such institutions and the expenses of students.

"Everyone, from president to shop or road foreman, feels that the success of his enterprise depends more upon having the right man in the right place than upon any other thing, and it is to this point that I would call attention: The American Techinacl School will supply railroads with men. Not laborers, but leaders; not imitators, but originators; not through any process of favoritism, but because of real ability and worth; not because of what the school teaches of railroads, but because what it does teach is the basis and foundation of the science of construction and operation of railroads.

"The success attained in railroad development is commendable, but may we not hope for the same success with less waste of time and energy by spending a proper amount of time studying principles before studying their applications? Can we not bring the man to the same plane of development ten years earlier by requiring the boy to spend four years in a technical school?

"You will notice that the writer says 'will' supply railroads with men. That it has supplied some already many of you can attest, but as you look over the vast army of workers you will discover that back at the beginning of things, in the shops, in the offices, in the field, the sensible technical graduate has started. No longer can it be advisedly said that the technical graduate expects to step out of school into the president's chair. They are beginning at the bottom, and now they have started right, their progress will be more rapid. I predict the success of the technical graduate. The demand at present far exceeds the supply. Many important roads, looking to their future needs, are giving this subject thought and attention. The sons of railroad men are being sent to these schools, which shows the thought of the father. There is no escape from the belief that the railroads of the near future will owe much to the technical graduate, and it will certainly be within reason to predict that within twenty-five years many of the successful railroads will be maintained, operated and managed by the graduates of our American technical schools."

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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to improvements. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

We mentioned very briefly last week the fact that the Pennsylvania Railroad Company is experimenting with nickel steel rails. On another page appears an interesting letter from Mr. Brown, the Chief Engineer of the Pennsylvania, concerning this experiment, and to that letter the reader is referred for particulars as to the analysis of these rails and as to experience with them, so far as experience has gone. The experiment is interesting and important. Nickel steel rails have long seemed to be among the possibilities of the future, although we have supposed that they would be too costly to be used except in quite special cases; but the experiment is worth trying. At Chicago the other day Mr. Cushing of the Pennsylvania Lines spoke of the nickel steel rails in use on the Cleveland & Pittsburgh Division. He says that after two years' service they show hardly any wear and that they are standing up better than any other rails.

Those whose memory goes back twenty years ago or so, may recall the revolution in the grain trade which was promised as the result of deepening the mouth of the Mississippi. Barges were to take grain not only on the Mississippi, upper and lower, but on its principal tributaries, so that from St. Paul and Kansas City, as well as from St. Louis and Cairo, substantially all export grain would be towed down the Mississippi, at insignificant cost, to New Orleans, and there transferred to ocean steamers, leaving Chicago and the Atlantic seaboard cities to sell their elevators for old lumber. Well, the Mississippi was improved, large ocean steamers load at the New Orleans levees, and, moreover, that city has greatly increased its grain trade. In 1898 it received 40 million bushels of flour and grain, while before 1880 its maximum receipts were 15 millions. Moreover, it had but an insignificant grain export trade until the river improvement, while now most of its receipts are exported. St. Louis has its barge lines, which render important service, though the Upper Mississippi, the Missouri and the Illinois, not to mention smaller streams, are not much disturbed by them. St. Louis, which shipped 34 millions of bushels in 1879, shipped 65 millions in 1890, and has averaged 45 millions a year since then. But, of these considerable St. Louis shipments only 7,800,000 went down the river in 1898, and only 6,600,000 by water to New Orleans, and its largest shipments by this route (15,673,000 bushels) were as long ago as 1880, in the infancy of the trade, while the average since 1890 has been 6,325,000 by river to New Orleans, out of the total 45 million average shipments. Further, of the 40 million bushels received at New Orleans in 1898, only 7,600,000 bushels came by river, and all the rest by rail, and the Illinois Central Railroad alone brought more than 26 millions. The opening of the mouth of the river has developed chiefly, not the river, but the rail grain traffic. And yet the Mississippi is a considerable stream, open most of the year, and floating large vessels below St. Louis. Rail and river together, however, have not quite destroyed the more northerly grain markets. Chicago, which had shipped an average of about 90 millions a year for the ten years ending with 1879, and 125 millions in the last named year, shipped 287 millions in 1898 and has averaged more than 200 millions a year since 1889. The bearing of these observations lies in the application of them.

During the year 1899, 347 industrial corporations were organized, with a total capitalization of $3,593,530,000 (over 3½ thousand million dollars). The list has been compiled by the Commercial and Financial Chronicle, and is intended to include only "going concerns" and those which have vitality, and to exclude transportation companies. A large proportion of these corporations are simply combinations, or trusts, designed to obtain the economies of consolidation and the security of partial monopoly. Notable examples are the American Car & Foundry Co., $60,000,000, which owns, with few exceptions, the important car-building plants; the American Bridge Co., $67,500,000, which proposes to control the great competing bridge works. The 23 iron and steel companies, with an average capitalization of 19 millions each, are all combinations. In all of these cases the proportion of money finally withdrawn from other uses and invested in industrials is small. The combining manufacturers receive payment for their plants either wholly or in part in certificates of stock and cash. The cash is obtained by selling to the public a small part of the stock. There are, however, many entirely new industries, inviting new capital to exploit new propositions. To build and sell automobiles, 24 companies have been organized, with an average capital of 10 million dollars each. To handle liquid air, three companies invite investment in 25 millions of capital stock. To promote a locomotive smoke preventer, six millions is considered desirable. While all industries and the form of their promotion indirectly concern the railroads, the following incorporations of 1899 are especially interesting:

American Bridge	$67,500,000
American Car & Foundry	60,000,000
Columbian Electric Car Lighting & Brake	10,000,000
Doty Third Rail Electric	2,500,000
Electric Axle Light & Power	2,500,000
International Car Wheel	15,000,000
International Steam Pump	24,500,000
Locomotive Smoke Preventer	6,000,000
Magnus Metal	3,000,000
Murphy Safety Third Rail Electric	2,500,000
National Tube	80,000,000
Niles-Bement-Pond	8,000,000
Pressed Steel Car	25,000,000
Southern Car & Foundry	3,500,000
Strohm Automatic Electric Safety Block System	5,000,000
U. S. Cast-Iron Pipe & Foundry	30,000,000

There can be no question of the possible value to the community of great combinations of capital to make and sell. They afford ideal conditions for economy and stability, and the public may share in these benefits. That they are dangerous, no one will question. President Hadley illustrates it thus: "The game of old sledge is a good game; it is not dangerous. The game of draw poker is a better game; it is dangerous. It is dangerous because it is a better game." Aside from the possible misuse of power, there is not only danger, but also an evil record due to concealment and a lack of publicity in accounting. We are firm believers in non-interference; that corporations and individuals should be allowed, so far as possible to work out their own salvation, with only the absolutely necessary legislative control.

"Brittle" Rails and Phosphorus Content.

The editor of an esteemed contemporary, speaking of his own paper, said to us: "You can tell me anything you like. What is published in the Railway ———— is strictly confidential." Apparently, this is not true of the Engineering and Mining Journal. The editor of that important sheet must be gratified at the proof that he is receiving of the attention with which his journal is read. Recently he said:

"There has been much complaint in recent years, which is growing rapidly . . . of the increasing percentage of phosphorus in rails now manufactured—indeed so large is this that many of our rails are far too brittle to be quite safe, and an increasing number of 'accidents' from this cause may be expected. . . . The consequence will certainly be to throw much discredit on our rails, and this, at a time when we are building up our foreign market for them, is a very serious matter."

From various parts of the country we get letters and newspaper clippings repeating the "brittle rail" and "accident" part of this statement, with comments more or less intelligent. Apparently, the editor's anxiety is shared for the moment by the space writers of the daily newspapers.

The fact that the heavier sections lately rolled are, as Captain Hunt says, "comparatively unsatisfactory," is now an old story, but we have heard no complaint that they are brittle. Furthermore, we venture the statement that; speaking of American rails in general, phosphorus is not higher than it was a few years ago—say, for the sake of being somewhat specific, 10 years ago. Furthermore, rails do not break now more often than they did, say, 10 years ago. In other words, they are not more brittle; on the contrary, we should say that they break less often. We believe it is true that at least one western mill is using higher phosphorus now than five years ago, but that is not as high as it was 10 years ago, nor is it so high as to make the rails brittle. The result is lower carbon and a rail that does not wear so well.

We have heard recently of some rails of heavy section breaking through the bolt holes, and even elsewhere, but these breakages have been attributed to defective ingots, and such breakages have always occurred more or less frequently.

In recent months the high prices of rails, the great demand, the difficulty of getting deliveries, and the pressure to turn out tonnage, have, perhaps, resulted in an increase of certain bad practice; or perhaps have not increased this bad practice but have merely prevented its correction. The rails have been finished too hot, resulting in a coarse structure. But this has been notoriously true for many years. It is one of the bad features of modern practice that engineers have been trying to correct for a long time, and has nothing to do with the necessity of using high phosphorus ores. Metcalf, Hunt, P. H. Dudley Webster, and dozens of writers of less authority, have pointed out time and again within the last dozen years the fact that the final passes are run too hot.

There may have been recently an aggravation of another evil, namely, less care may have been taken to cut off a sufficient amount of the top of the ingot, and even the ingot has passed on to the rolls with the metal in its center still too hot, resulting in pipes and flaws. It seems probable that there have been broken rails within the last few months from these causes. Obviously, present market conditions make it difficult to force the rail mills to do their best. They are very independent, and often say, in deed, if not in words, "take our rails, or leave them, as you wish."

All of these facts and conjectures are, we repeat, quite apart from the question of phosphorus, and we have no apprehension of an increasing number of accidents from brittle rails.

The serious aspect of the situation is, however, that the railroads do not get the wear out of the recent rails that they were justified in expecting. Last October (page 694), writing on this subject, we said: "Lately there have been signs of a reaction from the strong tendency toward heavy rails. The heavy rails recently put in have not been always satisfactory; that is, the companies are not always getting the worth of the money put into the heavier sections in increased wear." And we said further: "It seems to be pretty general opinion among those who ought to know, that it is mostly the fault of the rail makers themselves that the recent heavy sections have been disappointing. They have not properly increased the amount of the hardening elements; they have not taken the proper precautions in the physical treatment." This is testimony that we get from men of the highest authority, and probably the physical treatment is considerably more important than the chemistry.

In our issue of Feb. 16, page 99, appeared an important article by Mr. William R. Webster on this subject. It is not very satisfactory to quote sentences or passages from that article, disconnected from the text, but we advise the reader interested in this subject to turn to it and read it carefully. That accomplished specialist in rails said: "I regret to state that we have more cases of 100-lb. rails that have broken in service than is desirable, and it is of the greatest importance to correct this difficulty by using the very best steel chemically and then to roll it under the best possible conditions to produce a fine-grain structure." We do not discover that he has noticed in these recent heavy rails a tendency to admit too high phosphorus, although he takes pains to point out that "a given amount of phosphorus has more effect in the presence of high carbon than with low carbon. The section of material rolled must also be taken into account, as the same chemical composition gives lower results in the heavy sections than in the light on account of the higher finishing temperature." He says further: "Each point of carbon added in these heavy rails makes it still more difficult to produce a fine structure in the head of the rail, as a finishing temperature that would give satisfactory results with the medium carbon heavy rail might be too high for the

higher carbon steel and give a coarse structure. In any case, as the carbon is increased the phosphorus should be kept down, or the rails may be brittle from that cause." We see that the matter is pretty subtle.

We are not denying that recent rails have been too high in phosphorus. Too high is not an absolute term. The phosphorus content may safely vary between moderately wide limits, depending upon the carbon and other elements and upon the treatment. We do question, however, very much the statement that rails are now either generally or often made higher in phosphorus than a few years ago; and we question if the rails turned out to-day are any more brittle than the rails that have been made any time within the last dozen or 15 years. The burden of proof is upon our esteemed and distinguished contemporary. It is for him to bring forward definite facts to prove his position. We should say, still speaking in general terms, that rails are now inspected more systematically and more intelligently than ever before in the history of the art, and that they are more carefully tested. Drop tests for every heat are now quite general.

Bearing upon this matter of phosphorus, Capt. Hunt made a significant and interesting suggestion in his discussion of the report of the rail committee at the recent meeting of the Maintenance of Way Engineers in Chicago. He said: "I think the day will come very quickly when the Bessemer converter will be relegated to the background to a great extent." At first sight this is astonishing; and yet, considering the advance in open-hearth practice, and considering the preponderance in our country of the non-Bessemer ores, Capt. Hunt's suggestion does not seem premature. We judge that open-hearth rails will be turned out in this country as soon as the commercial conditions are favorable—perhaps not speedily in great quantities, but in important quantities.

Back of all this, however, is the old and important fact that modern rails are finished too hot. We need not go into the metallurgical subtleties of this matter; they must be pretty well known to our readers by this time. Everybody who considers the subject at all recognizes the fact. In the report of the rail committee at the recent meeting of the Maintenance of Way Engineers mention was made of a plan for delaying the rails just before the finishing passes long enough to let them cool down. This is important and practicable. Not a great while ago a rail mill was offered an extra price of a dollar a ton to try this on a lot of rails. Obviously, as mills are now rigged, it could only be done by delaying the whole line of machinery, and consequently it could only be done at some odd time, as on a Saturday afternoon. The suggestion was not accepted by the rail makers.

The scheme now proposed, and said to have been patented, is to provide a hot bed immediately before the finishing rolls. The rails would move sideways across this hot bed at the same speed at which the material is moving steadily through the whole line of machinery, and consequently, after the bed is once filled there will be no delay in the delivery of the product. The material would continue to move at its present rate from the first rolls to the last process. But the width of this bed would be such that the time occupied by the rails in moving across it would allow them to cool down to a proper finishing temperature. Apparently, there are but two objections to this. One is that it will take more room; but ground space is a small item in the cost of producing rails. The other objection is that the rolls would be worn out faster by rolling the rail cooler, and, consequently, harder. But we hold that the primary object in having rolls is to make good rails. If this object is not attained, the rolls fail of their purpose, and it does not make much difference whether they are worn out or not.

The sum of the whole matter is that a few years ago the railroads would not, or possibly could not, pay such prices as would justify the mills in putting enough time and work into the rails to make as good rails as the makers knew how to make and as the engineers knew they ought to get. Now the rail mills are so driven with orders that even at very profitable prices they will not put enough time and work into their product. Here is the dilemma.

Ten-Years' Railroad Progress in Russia.

Russia until recently published so little information concerning its finances that few foreigners had any definite idea of its actual condition. For some time information has been issued more fully, and a regular budget is given with a report from the Minister of Finance on the economic condition of the country. That issued Jan. 1 last gives a sketch of the economic progress of the country for the last 20 years, with special reference to the national railroad policy.

According to this statement, few countries in the world have ever had so rapid an industrial development. The value of manufactured products increased 235 per cent. from 1877 to 1897, and no less than 80 per cent. since 1892. Such progress would be impossible but for the fact that the production in the early years was extremely small compared with the population. In 1877, for instance, it was at the rate of about $3.09 per inhabitant; in 1897, after all the growth, only $9.27. More than half the value produced in 1897 was in textile fabrics, one-sixth in metal fabrics, and the latter only at the rate of $1.50 per inhabitant. Nearly seven times as much coal was mined in 1897 as in 1877, and yet the total in the later year was but 13,428,000 tons, which is at the rate of about ⅛ ton per inhabitant; while here we produce something like 3 tons per inhabitant. This illustrates what we have said as to the rapid rate of progress being possible only in the early stages of the economical development of a country. The petroleum production in 1898 was, in weight, two-thirds of the coal production, and it has been developed almost wholly since 1877. But it increased 70 per cent. from 1892 to 1898, though from 1897 to 1898 only 6 per cent., which probably indicates a reduction in the rate of growth of this industry, unless new fields shall be discovered.

The production of iron and steel has increased very rapidly, but as in manufactures the aggregate is still very small compared with the population. Though nearly six times as much pig iron was produced in 1898 as in 1877, the larger production is still only 2,412,000 short tons for a population (exclusive of Asiatic Russia) of 105 millions. The recent progress is more interesting; and there was in pig iron an increase of 110 per cent. from 1892 to 1898, and of 19 per cent. from 1897 to 1898; no change in manufactured iron, and in steel an increase in 1898 of nearly 200 per cent. since 1892 and of 21½ per cent. since 1897. Still, the '98 production was only 1,620,000 tons, which is an insignificant amount for such a country.

This serves as an introduction to the account of the Russian railroad system and its relations to the country and the state, in which there has truly been something like a revolution.

In January, 1889, there were 18,304 miles of railroad in Russia, only 23.6 per cent. of which belonged to the state; the rest to 42 different companies, every one working independently and making its own rates. For deficits on its own lines and guaranteed interest on private railroads the state's losses in that year amounted to more than $15,000,000, and the debt of the private railroads guaranteed by the state was more than $490,000,000. The policy of the government was to secure an extension of the railroad system and at the same time to reduce its expenses. Some of the private railroads were bought, and the policy of concentration of lines, partly in the hands of the state and partly in those of a few great companies, was followed. In other cases the state, instead of exercising its right to purchase, agreed with companies either to secure a share of their net profits, or that they should undertake the construction of new lines. At the same time the government began to build new railroads more rapidly.

The result has been that instead of 42 companies as in 1889, there are now 9, which with 4,400 miles of new lines now under construction, manage a total of 14,576 miles of railroad; while the state system has increased to 19,284 miles, besides 2,997 miles under construction. Thus the Russian system since 1889 has very nearly doubled in extent, and the state system is 60½ per cent. of the whole instead of 23½.

Meanwhile the losses of the State on account of guarantees, etc., decreased from year to year, with one exception, until in 1894 it was but $2,000,000, instead of $15,000,000 as in 1889; and since then the railroads have yielded it an income—$900,000 in 1895, $5,650,000 in 1896, $6,250,000 in 1897, and $6,050,000 in 1898. This, however, does not include the results on the Siberian Railroad, which showed a loss of $2,225,000 in 1897 and of $5,550,000 in 1898.

The report, however, claims still greater advantages gained by the regulation and unification of railroad rates which the government has effected since 1889, of which we have given account heretofore on several occasions.

The Siberian Railroad being the great work of the time covered by the report, naturally much is said of it; and if in this there is not much new, it is at least important as the authorized official statement of the Russian government concerning this great enterprise:

"This line, connecting the coasts of two oceans by a continuous railroad, acquires universal importance since the Chinese government has given it an outlet through its territory to the ice-free Yellow Sea, and has granted the Kwantun peninsula to Russia. In this territory, at the terminus of the railroad, the port of Dalni was founded during the past year and made a free port. The favorable position of the new city as the terminus of the great transcontinental railroad, and the privileges granted it, will doubtless contribute to its rapid growth and prosperity, attracting the commercial marine of all nations, so that it is reasonable to hope that Dalni will become one of the chief emporiums of the traffic between the Old World and the New.

"The construction of a railroad across the whole of Asia is a great and difficult work which has required, and requires still, great effort and great expenditures. Almost everywhere on the whole line the most various obstacles had to be overcome, in a continuous struggle with the most difficult circumstances of climate and topography. The construction in Manchuria offers almost unexampled difficulties. There little groups of Russians have to build the road through an almost unexplored country, exposed to the greatest hardships. But there are no difficulties which the Russian people cannot overcome at the command of their ruler; and the work on the Chinese Railroad is going forward rapidly. At present already about 530 miles of track is laid, and for 296 miles, from Port Arthur to Mukden, the trains are running, and a telegraph line is completed along the whole main line and the South Manchuria branch.

"Great also is the money sacrifice which the Russian people have had to make for the construction of the Siberian Railroad across Asia. When Russia and its finances are discussed, it must not be forgotten that the Siberian Railroad is now for the most part completed, and that the means for executing this gigantic work have been supplied by Russia itself. Already, within a comparatively short period (from 1891 to 1899 inclusive), $258,000,000 have been expended on it; in the year 1900 about $65,000,000 more will be spent, the means being already provided; and for the completion of the work $75,000,000 to $90,000,000 more will be required. The entire cost will therefore exceed $385,000,000. The money has been provided chiefly from the general resources of the treasury, and only $50,000,000 has been raised by extraordinary means. Now the time is near when these heavy drains on the treasury for the railroad will cease.

"The present burden, now most severely felt, conceals the future importance of this great railroad and prevents the proper appreciation of its value. Difficult as this civilizing work may be, it will reward all sacrifices a hundred fold, when, after its final completion it bears its rich fruits; when the great line connecting the farthest boundaries of Europe and Asia is active in the service of the development of the distant Orient, and sets at work the productive powers of rich Siberia."

We believe that it is not generally understood to how great an extent the capital of the Siberian Railroad and the other new Russian lines, in the aggregate much more extensive than the Siberian, has been supplied by Russia itself.

The amount of the expenditure on the Siberian Railroad as here stated is enormously greater than the estimates, and amounts to about $80,000 per mile. It doubtless includes, however, interest on the expenditures for an average of about five years. While the aggregate expenditure is so great, it must be remembered that it has been so far on the average since 1891 little more than $30,000,000 a year; and the whole growth of the Russian railroad system, extraordinary for that country, would be very slow here, where as long ago as the decade ending with 1870, we added 22,000 miles to our system, besides conducting one of the greatest and costliest wars ever known; while in the two following decades the miles added were 40,000 and 73,000 respectively, which makes the additions of 11,000 (actually completed) in Russia in the last ten years appear comparatively insignificant. And in the matter of capital, in the year when we built 13,000 miles of railroad, probably as much was invested in them as will be in the Siberian Railroad in ten years. But we must also remember that great as Russia is in extent and in population, it is still industrially an infant, and not properly to be compared with the great industrial nations. The normal economical growth of such countries as this, or as Germany and Great Britain, would doubtless quickly exhaust Russia. The important thing to observe is that the infant is learning to walk alone and that, though it may stagger, stumble and fall many times and suffer greatly while it is learning, it has apparently set out resolutely to learn; and being a big and growing child, in time much may be expected from it.

Annual Reports.

Missouri Pacific.—The annual report of the Missouri Pacific for the fiscal and calendar year ending December 31 last, shows the features which have marked the history of the company for several years past. There was a very large expansion in gross revenue and traffic movement, with a large part of the increased revenue absorbed by heavy improvement work which, on the other hand, enabled the traffic to be moved with more economy. The readjustment of the finances, particularly in the refunding of high interest bearing bonds by the issue of low rate bonds in their place, has proceeded, and practically all the bond issues subject to refunding have now been paid off or exchanged.

The readjustment of the bonded debt, and the fact that all the premiums, discounts, and other charges in connection with it are carried in the year's income account, obscure the changes in the items after net earnings, and materially decrease the apparent surplus. Thus, while the net surplus is carried as $640,926 for 1899, a decrease of $538,973, as compared with the previous year, the actual surplus representing the balance earned over expenses and the normal fixed charges would have been correctly represented as $1,555,000, a balance about equal

to 3¼ per cent. on the oustanding stock. The difference represents the excess of extraordinary expenses in connection with the refunding, over the extraordinary receipts from the same source. The premiums paid on old bonds exchanged before maturity, bankers' commissions, etc., amounted to $1,774,000, while premiums from bonds sold to effect the exchanges yielded $860,000, the difference between these two amounts, $914,000, when added to the actual surplus, increasing that figure to $1,544,000.

The changes in the income account being thus confused by the way in which these items are carried, it need only be stated that the increase in gross earnings was $3,555,000, or 5 per cent., operating expenses increasing $460,000, or 2.4 per cent., while net earnings increased 11.6 per cent. The number of tons of freight moved increased 8.2 per cent. and the number of passengers carried by 9 per cent. The freight department furnished more than half the increase in gross, or $824,290. The ton-mileage increased about 147 millions, or 6½ per cent., but the freight train mileage was 591,000 miles, or 1.8 per cent. less than in 1899. This was in part due to better loading of the freight cars, to the better success in keeping the company's equipment on its own line, and the increase of the number of cars per train. Thus the mileage of loaded cars increased 3.4 per cent., the empty car-miles increased only 1.6 per cent., so that the total car mileage was only 2.9 per cent. higher than in 1898. The tons in each loaded car were 13.1 against 12.5 in 1898, an increase of 4.8 per cent. The revenue train-load is now reported as 211 tons, as against 194.5 tons in 1898, an increase of 8.5 per cent. in a year, and of 33 tons since 1894.

Besides the rebuilding of the equipment carried on extensively last year, as instanced by the rebuilding of 97 locomotives against 80 last year and similar work, the most important improvement in progress in the year was the revision of the alignment and grades on the Iron Mountain division. This work, while uncompleted at the end of the year, had progressed far enough to already result in an important increase in the average number of cars per train, the engine capacity between Newport and Little Rock being increased by 15 loaded cars per train. The use of heavier engines on other portions of the road has resulted in increases of from 2 to 7 loaded cars per train.

Texas & Pacific.—In volume of earnings, of traffic carried, economy of train operations, and financial progress, the annual report for the year to Dec. 31 last is the best ever made by the company. In view of the large surplus shown the recent declaration of a dividend on the $25,000,000 outstanding second income bonds was a matter of course. Such a declaration could easily have been made in other years, so far as regards the actual balance over fixed charges. This for some years has been sufficient to show a balance on the second income bonds. Instead of using it for this purpose, however, the surplus has been devoted to the purchase of new equipment, carrying on improvements and in clearing up old accounts, so that all the floating debt was paid off, and the financial accounts were in excellent shape when the income interest payment was made. The 1½ per cent. paid called for about $350,000, there being an available balance of $447,000. The following figures give revenue comparisons for the last three years:

	1899.	1898.	1897.
Freight earnings.....	$5,744,743	$5,768,602	$5,685,170
Pass. earnings.....	1,878,086	1,768,772	1,463,628
Total gross.....	8,300,186	8,006,504	7,588,649
Operating expenses....	5,848,866	5,707,465	5,473,003
Net earnings.....	$2,451,320	$2,299,039	$2,115,646

In 1899, but for an increase of $109,314 in passenger receipts, traffic income would have shown a loss, the freight revenue falling off $23,859 despite the increase of 247,000 tons in the number of tons and of 50½ millions in the ton-miles. The decrease in revenue is attributable to the heavy loss in cotton tonnage. The cotton tonnage, because of the high classification it takes, ordinarily furnishes approximately a fifth of the total freight revenue. In 1899, however, the receipts were only 10.3 per cent. of the total freight earnings. The results of the changes in the cotton tonnage and in general business shown by the company become more than usually important because to some extent they serve as an index to the conditions on other lines. The other cotton carrying lines should show relatively as heavy loss in this tonnage, and it remains an open question whether general business will make up the loss. The grain carrying roads have also had a light movement in that commodity for months past, but a larger business in general freight.

The report makes no reference to one of the interesting developments in connection with the company's future. This is the operation by which the Missouri Pacific, with which the Texas & Pacific exchanges a larger amount of freight than with any other road, obtained over $22,000,000 of the $23,212,000 Texas & Pacific second income bonds. This necessarily brings the two roads into closer relations, and it would facilitate a merger of the two properties, though as yet no steps have been suggested with this end in view.

On the first of April the railroads of France are to make radical reductions in the hours of work of certain enginemen, firemen and other trainmen; and if we may judge by the tenor of the articles from which we get this information the reduction is to be very general, so much so that it will entail a large additional expenditure for wages. The change is made in compliance with an order from the Minister of Public Works, who has decided that the classes of men mentioned ought to work shorter hours and has accordingly sent his order to the Northern, Southern, Eastern and Western roads; the Paris, Lyons & Mediterranean, the Paris & Orleans and the Paris Belt railroad. The Minister of Public Works, Mr. Pierre Baudin, is a pronounced socialist and it is said that he was appointed to his present place in order to "favor the working classes." It is to be borne in mind that the State guarantees the dividends of the railroads. The principal clause of the regulations now issued requires that enginemen and firemen shall not, as a rule, perform over 10 hours' actual work in a day, and must have at least 10 hours' complete rest. These figures represent the maximum average working time and the minimum average rest time. A man resting away from his home may be made to accept as short a period as seven hours, but no two consecutive rest periods shall be less than 17 hours. Where a man is on duty for a long day he should not have more than 12 hours of actual work. Every 10 days, on an average, the employe must have a long rest of at least 24 hours, which should be taken at home. The maximum interval between these long rests should not exceed 20 days. When men have to be on or near their engines the time must be counted as actual work, and the time on duty before beginning and after leaving work must ordinarily be counted as work. When men have to wait around the station while yet not on duty, their time, if counted as rest, must be diminished 75 per cent.; that is to say, four hours of such rest would count only as one hour. When men have to work longer than usual, by reason of emergency, the company must report the circumstances to the Government. The similar regulations for other trainmen are very much like those for enginemen, except that the day's work may be a little longer and the minimum prescribed rest is a little shorter. These men should have a long rest every 15 days. On the easier trains, like express trains and through freight trains, the working time is to be diminished 10 per cent. before the figures are used for the purposes of these regulations. The Government officials (Engineers of control) are to watch the new regulations closely and see that they are enforced.

Notes on the Eastern Railroad of France.

As most of our readers know, there is but little competition on the railroads of France. The territory is parceled out between the six great private companies. The northern and northeastern parts of the country are allotted to the Northern Railroad of France, the northwestern part to the Western Railroad, and the west central to the Orleans (which has a competitor in the state lines); the central and southern to the Paris, Lyons & Mediterranean and the southwestern to the Midi. The eastern part of France is controlled by the Eastern Railroad. As there is a considerable degree of uniformity extending throughout the railroads of France, a sketch of the Eastern will afford a very good idea of all of the lines. The locomotives are quite similar, the passenger cars are almost uniform and the stations show but little variety. The Eastern has three great main lines out of Paris, leading respectively to Belgium, Germany and Switzerland. This road joins with the Northern in a very creditable fast train service between Basle and Calais.

Passenger cars may be roughly divided into two qualities, those for main lines and express trains and those for branches and suburban traffic. Until about two years ago the former were considerably behind the times and on the branches the service was still poorer; and the Eastern was not any worse than the other great French roads; on the contrary, it was generally a little in advance of its neighbors. But within the last two or three years corridor coaches have been introduced on several of the express trains, which are as good as anything of the kind on the Great Northern of England or the London & Northwestern. These cars have only four wheels, but they have been carefully designed and are easy riding. The purpose in building short cars was to facilitate the use of all the different classes in a train without wasting room. The first-class cars have four compartments and carry 24 persons; the second-class have the same number of compartments, but with seats for 32. There are also first-class cars with two luxe compartments, each with three beds, one ordinary compartment for six persons and toilet rooms for each of the three compartments. The first-class corridor cars are upholstered in white cloth and the second-class have the cloth up to the baggage rack. The dimensions of the cars are as follows:

	First class.	Second class.
Length of compartment.....	7 ft. 1 in.	5 ft. 11 in.
Width of compartment.....	6 ft. 10 in.	6 ft. 10 in.
Height at center.....	7 ft. 4 in.	7 ft. 4 in.
Height at sides.....	6 ft. 4 in.	6 ft. 4 in.
Air space per passenger.....	56.5 cu. ft.	34.3 cu. ft.
Weight of car.....	37,744 lbs.	33,040 lbs.
Weight of car per passenger.....	1,574 lbs.	1,032 lbs.

The Eastern has probably the best station accommodations in France. At the smaller towns the buildings are always clean and neat and are painted the company's standard colors, blue and white. At the larger towns the buildings have considerable architectural character and the Paris terminus (Gare de Strasbourgh), has a front which is much admired. On the Eastern, as indeed all over France, the refreshment rooms are good, and meals can be obtained promptly at reasonable prices. In the matter of waiting rooms, some of these stations are rather bare and cold. Subways and other bridges are conspicuous by their absence and passengers who have to cross the tracks are conducted across on the level by a member of the station staff. Another criticism which might be made is that the time-tables are not posted with care, and where posted are sometimes in an inconvenient place to be read. At most of the stations the name is on the station lamps so as to be visible at night, and the sign gives not only the usual distances but also the altitude of the station above the sea.

In the matter of speed the best trains of the Eastern are now not far behind good British practice, though this company is not yet up to the level of the Northern, the Orleans and the Midi. Many of the through trains are quite heavy, though most of them are now free from third-class cars.

Fares are quite uniform on the French roads. Taking, for example, a distance of 140 kilometers from Paris, on four different lines, we find that the fares are just about the same, to-wit: 16, 11 and 7 francs, respectively, for the three classes; and there is a uniform reduction of 20 to 25 per cent., according to the class, where two tickets are bought together. These rates equal about 3.5 cents a mile for first-class, 2.3 cents for second and 1.5 cents for third. The French roads have the usual variety of season, seaside and other excursion tickets. At the holiday season a passenger may buy a mileage ticket for any combination of routes that he may fix up, and pay at the start for the whole journey, over any or all of the roads, and this is available to passengers by either first, second or third class. In short, it is the most flexible arrangement possible.

Sizes of Freight Cars in Australia.*

Mr. Oliver reports for the seven colonies in Australia, Tasmania and New Zealand. There is a length of about 700 miles of private owned railroad, but the principal railroads are owned by the Government, as follows:

Colony.	Gage. ft.	Gage. in.	Miles open.
New South Wales	4	8½	2,648
Victoria and part of South Australia.....	5	3	3,611
South Australia, Queensland, Western Australia, Tasmania and New Zealand...	3	6	7,601
			13,860

In South Australia the wide gage is chiefly confined to the connection with Victoria. The two wide gages serve the largest population and it is probable that Victoria will eventually adopt the 4 ft. 8½ in. gage. The state roads own 38,524 freight vehicles; total capacity, 303,847 tons (of 2,240 lbs.). Four-wheeled cars are built to carry up to 10 tons, and cars on two trucks carry (on narrow gage) seven tons and (on broad gage) 43 tons. Four-wheeled cars make up 81 per cent. of the whole carrying capacity of cars owned. Only nine per cent. of the cars have fixed covers and these are chiefly four-wheeled cars. Wool constitutes such a large portion of the freight that it is important to obtain the largest possible floor space. The Victorian standard wagon has 136 sq. ft. The N. S. W. standard is 8 ft. 4 in. wide and has 130 sq. ft. The lightest wagon, compared to the paying load it will carry, is the Victorian steel wagon, weighing 1,316 lbs. per 2,240 lbs. of load. A wagon made entirely of wood on the Queensland narrow gage lines weighs only 1,064 lbs. per ton of load. Eight-wheeled cars on the N. S. W. roads with wood and iron underframes carry 24 tons and have 263 sq. ft. of floor space. These cars are 31 ft. 7 in. x 8 ft. 4 in. The Victorian roads have a similar wagon with a steel underframe and total length over buffers of 38 ft. 5 in.; and they have a few steel hopper coal cars 51 ft. 5 in. long. This last type weighs 17 tons and carries 43 tons. The N. S. W. roads have hopper coal cars with detachable bodies which can be slung over the hatchway of a ship.

The general opinion is that open cars are more convenient and economical for most freight, except fruit, dairy produce, fresh meat and explosives. Tarpaulins are, of cause, used when required. Timber

* Abstract of a paper by Charles Oliver, Chief Commissioner of the New South Wales Government Railroads, on the question of "The Economical Size of Goods Trucks"; to be presented at the sixth session of the International Railway Congress at Paris, 1900.

is plentiful in most of the colonies and metal has not been used much except in Victoria, though iron, steel and composite underframes are used. The life of an ordinary wooden goods wagon in New South Wales averages 20 years. Metal frames have not been used long enough to permit of conclusions as to durability. In Victoria 171 iron wagons have been in use since 1873. Within the last two years that colony has adopted steel for its standard wagons. Comparing small and large cars, Mr. Oliver presents the accompanying table:

Railways.	500 tons of goods loaded in Small wagons. Weight of Vehicles.	Number of Vehicles.	Length of road occupied.	Large wagons. Weight of Vehicles.	Number of Vehicles.	Length of road occupied.
	Tons.	No.	Yards.	Tons.	No.	Yards.
New South Wales..	305	50	328	242	21	250
Victoria.....	293	50	356	256	20	257
New Zealand.....	286	84	490	235	32	347

The traffic in wool, grain and other raw materials from the interior is concentrated in the summer months, and during this time empty cars must be moved from the seaboard to the interior. Even when traffic is at its maximum it is still advantageous to have small wagons, because the traffic has to be gathered from such a large number of small stations. To accommodate the small producer rates are made in New South Wales for six-ton lots of agricultural produce, and in Victoria and South Australia for three-ton lots. In New South Wales, where the maximum capacity of cars is from six to 10 tons, the average carload from the country to Sydney is 12,404 lbs., while from Sydney it is only about two-thirds this quantity. Mr. Oliver concludes that if large 24-ton cars were substituted for the open cars in New South Wales there would be an insuperable difficulty in distributing cars to the 569 stations during the busy season. The great advantage in using large freight cars is fully recognized, but it is believed to be impracticable to profitably use a larger proportion than at present. Where possible the four-wheeled cars have been strengthened by the use of larger axles. Six hundred four-wheeled cars, carrying 10 tons each, have lately been built.

The Union "4-C" Relay.

The engravings given herewith show the construction of the "4-C" relay for automatic block signals, made by the Union Switch & Signal Co., of Swissvale, Pa., which was briefly described in the Railroad Gazette of March 16. Most of the parts of the relay are so well shown by the drawings that no explanation is necessary. In the plan drawing, w, the binding posts are indicated by TT track wire or main circuit, B local battery, S signal wire, and C common or return wire. The distinctive feature of this relay is the device for preventing the signal from remaining in the all-clear position in case the contact points at *a*, should become fused by lightning and remain stuck together. In such case *a* becomes the fulcrum and when the coils are de-energized, the lever *ac* drops at its right hand end, this being made possible by the introduction of the pivot at b. Connection is thus made at c and the local or signal current flows from the battery through *ac* and, by a wire connecting c with C, back to the battery, thus weakening the current through S and the signal magnet sufficiently to allow the signal to go to the stop position.

The box which encloses the working mechanism of this relay has top and bottom plates of brass and sides, gg, of plate glass. By using the small hole at e the armature can be moved with a long needle. One of the screws, f, by which the case is held together, can be covered at the top with a wax seal, thus enabling the chief inspector to keep a record of all occasions on which the box is opened. The delicate parts being enclosed in the air-tight box, this relay can be used in battery wells or other damp places.

To get a clear idea of the glass bearings used for the armature pivots, the reader will have to exercise his imagination a bit. The screws, of which the threads are shown in plan x and elevation y, are hollow; and the bearing, which is a short piece of cylindrical-shaped glass, is inserted in the end of the screw. This glass is about ⅝ in. long; and to avoid failure in case of fracture it is encased in a hard rubber cap, which is screwed on to the brass screw.

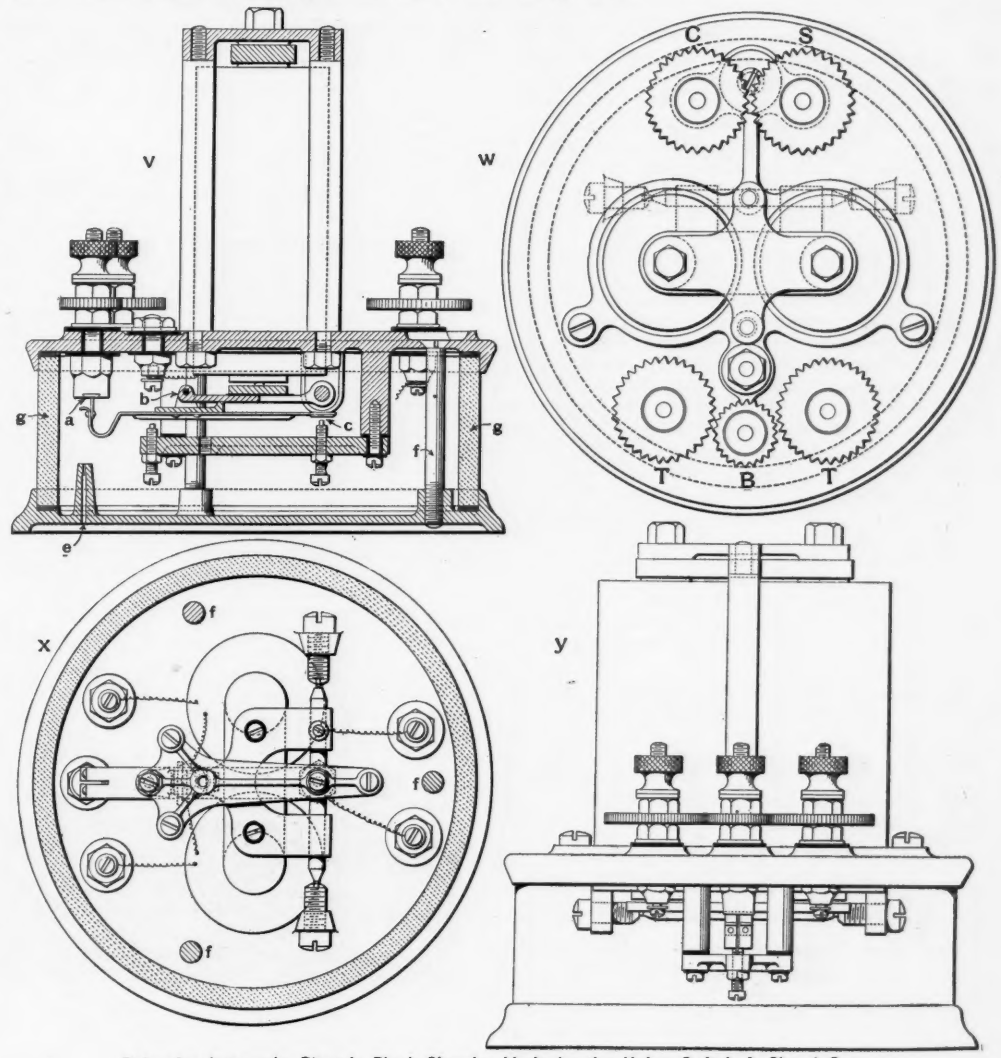
It will be noted that the wire running from one coil to the other, shown in plan x, is in two parts, which are connected at a binding post midway. This is to make it easy to take out one of the coils without disturbing the other; and this binding post extends upward through the cover of the box so that each coil can be tested separately from the outside. All of the magnet wires are secured to the binding posts by screws, no solder being used.

The same box and framework are used for either one, two or three-point relays. The screw carrying the main contact point can be fitted interchangeably with either a carbon or a platinum contact. The U-shape of the end of the armature, combined with its lightness, makes it sufficiently elastic so that when it is drawn up the contact point is made to slide on the carbon or platinum surface, which makes the connection self-cleaning.

In two-point relays the contacts are balanced so that the pressure is equal on both, even if the adjustment be not the same.

POLARIZED RELAY FOR DISTANT SIGNALS.

The Union Company now works automatic distant signals without a line wire. Each distant signal being on the same post with a home signal, the track circuit governing the home signal is made to govern the distant also, by means of a polarized relay; or, rather, a combined simple and polarized. The relay opens and closes the local circuit for the home signal in the usual manner, without regard to the direction of the current, by means of an armature at the ends of the cores, but closes the circuit for the distant only when the current flows in a given direction, an armature to be moved by the reversal of the direction of the current being added between the coils. This reversal is effected, of course, by the home signal at the next post in advance—the one for the second block-section in advance—which block-section is the one for which this distant signal gives indications.



Relay for Automatic Electric Block Signals, Made by the Union Switch & Signal Co.

TECHNICAL.

Manufacturing and Business.

A charter has been issued in Pennsylvania to the Braddock Tool Co., with a capital of $25,000; the directors are William Seng, Charles Wolf and John A. Loen.

The moving of the St. Louis works of the Chicago Pneumatic Tool Co. from St. Louis to Detroit is causing some stir in Detroit, as there are no vacant houses for the workmen, and the housing of the employes is a problem that the landholders and real estate men are trying to solve. The site of the new location is at the corner of Second Ave. and Amsterdam St. The employes will be brought to Detroit by special trains. The Chicago Pneumatic Tool Co., who manufacture tools for all purposes, run by compressed air, have another large factory at Philadelphia. The Detroit people are fortunate in securing this industry, as it is one of the most rapid growing industries in the country to-day.

Standard wheels, made by the Standard Steel Works, have been specified for the 56 cars ordered by the Metropolitan Elevated of Chicago and noted in our issue of last week.

Monarch brake beams will be used on the 500 box cars and 200 furniture cars for the Chicago Great Western, noted in the Car Building column in our issue of Mar. 16, and not Kewanee brake beams, as previously reported.

Gordon H. Quinn, who represented the Detroit Steel & Spring Co. at Chicago for about 15 years and was formerly in the office of the Vice-President of the Pullman Co., died at Chicago on Mar. 15 of appendicitis. The funeral services were held from his home in Chicago on Mar. 18, interment being at Rose Hill.

The Howard Cross-Tie Co., with a capital of $50,000, was incorporated under the laws of West Virginia March 25, by Wm. B. Howard, E. J. Howard, H. K. Blake and K. D. Blake of Philadelphia, and J. M. Hawkins of Parkersburg, W. Va. The principal office will be in Philadelphia, Pa. H. K. Blake, 315 Stephen Girard Bldg., Philadelphia, is the Attorney.

The Albany Contracting Co., of Albany, N. Y., has been incorporated in New York, with a capital of $25,000, to carry on a general construction business which will include building bridges and railroads, dredging, etc.

Clarence H. Howard, for the past eight years Secretary of the Safety Car Heating & Lighting Co., has resigned to accept the Vice-Presidency of the Shickle, Harrison & Howard Iron Co., of St. Louis, Mo. Mr. Howard was at one time general foreman and Assistant Master Mechanic of the Missouri Pacific RR., and was later connected with the Missouri Car & Foundry Co., the Scarritt Furniture Co., and the St. Charles Car Co. His father, who died recently, was for many years Master Mechanic of the Union Pacific RR. The plant of the Shickle, Harrison & Howard Iron Co., at St. Louis, is running day and night, and it is expected that the new building at East St. Louis will be turning out steel castings by April 1.

Iron and Steel.

The National Tube Co., Pittsburgh, Pa., has an order from the Government for 70,000 tubes or 500,000 ft. The price is said to be $225,000.

Representatives of about 30 of the sheet steel makers of the country met in New York City March 26 to further the plans for the formation of the American Sheet Steel Co. The proposed consolidated company is to have a capital stock of $55,000,000.

The Springvalley Iron Co. was incorporated in West Virginia March 24, with a capital stock of $120,000, by James W. Jones, F. B. Kellogg, C. W. C. Withee, Geo. H. Prince and H. W. Parker, all of St. Paul, Minn., at which place the pricipal office will be. Davis, Kellogg & Co., Merchants' National Bank, St. Paul, are the attorneys.

The property of the Hillman Shipbuilding Co.,

adjoining the plant of the Cramp Ship & Engine Building Co., is reported sold to the latter company for $250,000, to be used as a repair shop by the Cramps.

A company is being formed by John F. Stairs and others of Halifax, N. S., who propose to build a new steel works at North Sydney, Cape Breton.

The new plant of the Hussey-Truxall Steel Co., at New Kensington, Pa., has been started. Both hot and cold rolling departments were put in operation Mar. 26. The company's product is confined principally to fine steel forgings, for shafting and machinery.

The Westinghouse Friction Buffer.

Much interest is being taken in the use of Westinghouse friction buffers at the rear of locomotive tenders as described in our issue of March 2 last. The Illinois Central will so equip twelve locomotives now building at the Rogers Locomotive Works, the Iowa Central two engines, the Colorado Midland six locomotives and a private car, and the Chicago & Alton a private car. A number of other roads are considering using friction buffers on cars and locomotives.

The Carnegie Company.

The Carnegie Company was incorporated in New Jersey March 24. The capitalization is $160,000,000, all subscribed, the par value of the stock being $1,000. The principal shareholders are: Andrew Carnegie, New York, 86,379 shares; Henry Phipps, Pittsburgh, 17,226 shares; H. C. Frick, Pittsburgh, 15,484 shares; Charles M. Schwab, Braddock, Pa., 18,929 shares; and Francis J. F. Lovejoy, Pittsburgh, 7,024 shares. There are seven other persons holding over 500 shares each of the stock and 23 others owning less than 500 shares each.

The stockholders of the new company, at Pittsburgh, Mar. 27, elected the following Board of Directors: Charles M. Schwab, Henry Phipps, George Lauder, William H. Singer, Andrew M. Moreland, Thomas Morrison, James Gayley, Thomas Lynch, Lawrence C. Phipps, Daniel M. Clemson, and James B. Dill. The board organized and elected the following officers: President, Charles M. Schwab; First Vice-President, Lawrence C. Phipps; Secretary, Andrew M. Moreland; Treasurer, William W. Blackburn; General Counsel, Knox & Reed and James B. Dill. The officers of the Carnegie Steel Co., Ltd., without exception, were elected officers of the Carnegie Steel Company, a Pennsylvania corporation. The officers of the H. C. Frick Coke Co. and other constituent corporations of the Carnegie Co. remain as heretofore. The Carnegie Company will assume formal control.

Consolidation Engines—New York, Ontario & Western Railway.

Last week, page 185, we printed an engraving and description of some new consolidation engines for the New York, Ontario & Western. In the description the weight on the drivers was given as 170,200 lbs. It should have been 177,200 lbs.

A Cement Plant for Texas.

Plans and specifications for a new cement plant for the Austin Portland Cement Co., at Austin, Tex., are being made by the Osborn Co., of Cleveland, O.

Interlocking.

The Chicago, Rock Island & Pacific is to put in two interlocking plants at Des Moines, Ia., one at East Eighteenth Street and the other at West Eleventh Street., at an estimated cost of $16,000. Freight trains are to be diverted from the main line between these points, and run around on the old Fort Dodge tracks over the old Keokuk bridge on Market Street. By this arrangement the main line between West Eleventh Street and the yards on the East side will be kept entirely free for passenger trains. The bridge on Market Street will be strengthened.

Another Cement Works.

The Calumet Portland Cement Co., recently organized at Chicago with a capital stock of $100,000, has leased a tract of land for 10 years from the Chicago Junction Railway Co. The land is on that road and fronts 480 ft. on Lowe Ave. and 125 ft. on Thirty-ninth St. Two large buildings will be built on the site, one for use as a factory and the other for a warehouse. The officers of the new company are C. B. Sears, President; W. S. Humbert, Vice-President; B. W. Grable, Secretary; W. L. Hodgkins, Treasurer.

Automatic Couplers in England.

The Railways (Prevention of Accidents) Bill is awaiting its second reading in the House of Commons and Transport says that its passage into law in its present form would be a grave menace to the carrying trade of the country and particularly to small traders who carry on their business with their own cars. The bill which was brought forward last year, and failed to become a law, was precise. The owner of freight cars would have known that he must prepare himself for equipping with automatic couplers and other safety appliances at the end of five years. The bill now before Parliament would give to the Board of Trade power under which it could immediately compel the adoption of automatic couplers. The report of the Royal Commission on accidents, to which we have several times referred, said that any positive obligation to apply automatic couplers should be preceded by investigation and experiment; the fullest practical tests and trials should be made of any automatic coupler before its application was ordered. But the bill actually brought forward empowers the Board of Trade to require the use or disuse of any plant or appliances, but so far as we discover does not fix the minimum period within which such requirement shall be carried out. It strikes us that this is one of those remarkable efforts at socialistic legislation of which Great Britain has seen a number of examples within the last few years, and we should not suppose that it would be possible to pass an act so broad and unrestricted as this appears to be.

Steam Heating on the Pennsylvania.

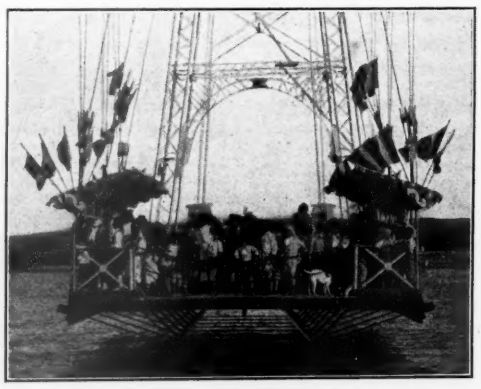
The newspapers have recently said something of experiments on the Pennsylvania Railroad with a new system of heating. We are officially told that these experiments are merely to test the possibility of doing away with the vacuum pump which is now used in connection with the return system of steam heating. These tests are still in the experimental stage.

Pipe Galleries in New York.

At a meeting of the New York Rapid Transit Commissioners last Thursday Mr. Parsons presented estimates for pipe galleries along Elm street from the lower side of Worth street to the north side of Astor Place. He estimates the cost at $425,000. A resolution was drawn up and held over until the next meeting because of the absence of three of the Commissioners to give notice to the contractor that the Board requires from him the additional work involved in building these galleries.

Bridge with Suspended Carrier.

Jan. 26, page 52,we published a short description, with illustration, of a bridge with suspended carrier proposed for the ship channel at Duluth, Minn. This has brought to us a letter from Mr. F. Arnodin, of Chateauneuf-sur-Loire (Loret), France, with a pamphlet and photographs. Mr. Arnodin designed a number of years ago a stiffened suspension bridge with suspended carrier to be used in places where a great height and considerable span are required. The scheme is precisely that which Mr. McGilvray proposes to use at Duluth. Indeed, he says that his device is an adaptation of the bridge over the Seine at Rouen, which latter bridge was built by Mr. Arnodin, which has built a bridge of this character at Las Arenas at the mouth of the Nervion in Spain.



This last bridge has a span of 525 ft, and a clear height above the highest high water of 147½ ft. The suspended carrier weighs 40 tons and the crossing is made in one minute. This suspended carrier has a wagonway in the middle and footpaths on the sides, the latter being provided with seats. It can hold 150 persons. The deck of this carrier is flush with the landing and the loading and unloading can be accomplished very promptly. The carrier is suspended from rollers which run on a track on the bridge overhead and are propelled by a cable and steam engine. Mr. Arnodin has built a similar bridge at Bizerte, Tunis. The carrier of this is shown in the engraving, as is a part of one of the towers.

The Railroad Supply Men at the June Conventions.

The annual conventions of the Master Car Builders' and Master Mechanics' Associations will be held at Saratoga Springs, N. Y., during the week of June 18, 1900. The Grand Union Hotel has been chosen as headquarters for both conventions. The standing committee of the supply men has arranged for space for exhibits in the court at the Grand Union Hotel, and allotment of space will be made by the secretary of the committee on application at his office, 1660 Monadnock Block, Chicago. In applying for space exhibitors will confer a favor by stating whether they desire space on the veranda under cover or in the open court. No heavy machinery can be placed on the veranda. Parties desiring power for machinery would do well to make arrangements therefor at as early a date as possible. The committee has arranged for conducting steam to a central point, from which exhibitors desiring to use steam will be at liberty to make connection, furnishing their own piping and fittings. Electric current can be had from the city wires at cost by applying either to the secretary of the standing committee or to the proprietors of the Grand Union Hotel.

Air Brake Appliances and Hose.

The Master Car Builders' Committee on Air Brake Appliances and Specifications for Air Brake Hose, appointed at the 1899 Convention, to confer with representatives of the air brake manufacturers, and to report its findings to the 1900 Convention, desires the co-operation of the Members of the Master Car Builders' Association in assembling information of value concerning the question of Air brake Appliances and Specifications for Air Brake Hose. The Committee would be under obligations for an early reply to the following inquiries:

1. What recommendations do you consider advisable to adopt as additional standards for Air Brake Appliances?
2. Have you adopted standard truck levers?
3. Do you use inclining levers on both trucks in the same direction?
4. Do you consider it advisable to use special specifications for brake beams for cars of 80,000 pounds capacity and over?
5. What is the maximum capacity of car on which you have found an 8-inch cylinder satisfactory?
6. Do you consider the use of slack adjusters advisable? If so, for what class of cars? What style have you used, and what has been the expense of maintenance?
7. Do you think it advisable to provide additional air brake power on cars of very heavy capacity, such as 80,000, 90,000 and 100,000 pounds? If you have had any experience in this line kindly give the committee any suggestions you may have to offer regarding the best method of obtaining this result.
8. Have you made use of the suggested specifications of the Committee on Air Brake Hose, as shown in its 1898 report? If so, what has been the result? If you do not use specifications as suggested by the committee, and purchase on other specifications, please enclose copy and state your experience with same.
9. What would you recommend as the proper inside and outside diameter of hose?

One should forward replies and blue prints, showing standards of Air Brake Appliances (and refer to any special features) to A. L. Humphrey, Superintendent Motive Power, Colorado Midland Railway Co., Colorado City, Colo.

THE SCRAP HEAP.

Notes.

The Baltimore & Ohio has established an electric automobile cab service at Washington.

In the United States Court at Scranton, Pa., March 22, damages of $55,500 were awarded in a suit by John T. Martin, a lawyer, against the Delaware & Hudson for injuries sustained by the plaintiff while riding in a passenger train.

The wages of the 1,000 employes in the New York Central car shops at East Buffalo have been increased 10 per cent. The increase is granted to machinists, blacksmiths, mill hands, carpenters, car repairers, laborers. The company made the advance voluntarily and it came as an agreeable surprise to the men.

On the Kansas City, St. Joseph & Council Bluffs near Langdon, Mo., about two o'clock on the morning of March 23, a single robber took about $600 in money and valuables from the passengers in a sleeping car. The robber boarded the train at a station and after it had run some distance he succeeded in intimidating the rear brakeman and compelled him to go through two sleeping cars waking the passengers and ordering them to hand over their valuables to the robber. The robbery was completed in ten minutes, and then, pulling the bell rope, the thief got away.

Traffic Notes.

The Southern Railway is adding a number of vessels to its barge line by which coal is carried from Greenville, Miss., to New Orleans.

It is estimated that 23,000,000 bus. of grain will be carried from Duluth by boat when navigation opens, of which about 19,000,000 bus. will be wheat.

It is said that the railroad commissioners of Texas intend to revise many carload and commodity freight rates in that State. There is a widespread demand for reductions in rates and the commissioners appear to be preparing to comply with it.

The Illinois Railroad Commission, which has been asked by the railroads to revise the State freight classification so as to increase certain rates, has declined to make any changes until after conferring with the railroad commissioners of Iowa and Missouri. It is said that an attempt will be made to arrange a single classification which can be used in all three of these States.

The United States Court at Omaha (Judge Munger) has dismissed the suit of the railroads for an injunction to restrain the State Board of Transportation from enforcing its recent order reducing rates on live stock about 10 per cent. and on grain 30 per cent. The railroads claimed that the orders were not justified by the State rate law, which was the subject of a decision by the Supreme Court of the United States in 1898. The railroads will now have to comply with the order of the Board or else proceed in court to prove that specific rates are unreasonably low.

The Interstate Commerce Commission has approved the suspension of the long and short haul law on sugar carried from San Francisco to Kearney and Omaha, Neb., but holds that the difference between the rates to these two places has been too great. The competition of water routes between San Francisco and the Gulf of Mexico and farther East, and the competition of sugar refineries in the East, are held to justify a lower rate for the longer distance to Omaha; but it is declared that while the rate to Omaha is 50 cents, that to Kearney should not be over 65. The rate complained of is 77 cents.

The members of the Chicago Board of Trade, who complain that those of their fellow-members who do a very large grain business and have contracts

with the railroads, secure unlawful rates, to the prejudice of the complainants, have failed in their attempt to get the Board of Trade to adopt a rule which would stop the alleged injustice. The complainants, who claim that their grain business, which was not large, has been greatly damaged by the secret railroad contracts secured by their powerful neighbors, asked the Board to adopt a rule under which members securing unlawful railroad rates could be disciplined for uncommercial conduct; but the Board is not disposed to punish any member for manipulation of rates until after the Interstate Commerce Commission has heard the case and has decided that punishment is deserved. The complainants will now try to get relief through Congress and they are going to give their attention to the Cullom bill. The Business Men's League, and other bodies, of St. Louis, have sent to Congress a number of proposed amendments to the Cullom bill. One of these is to make railroad traffic associations lawful and another is to change the law so that the Interstate Commerce Commissioners shall be appointed for life or during good behavior.

Shippers Against the Cullom Bill.

There is one city where merchants and manufacturers have voiced a demand, evidently intelligently considered, that the Cullom bill be not passed, but killed. It is Milwaukee. Senator Spooner has laid before the Senate a protest from "some of the largest shippers of Milwaukee," which says, in part: "The whole theory of the proposed law is to take the rate-making power out of the hands of the railroad and place it in the hands of the commission appointed by the government. It establishes universal classification, and the power to make that classification is given to the commerce commission.

"While the law gives us the right to be heard, we would be dependent wholly upon the fairness and intelligence of the commission for the protection of our interests. We seriously doubt the ability of the commission to handle so large a business properly with fairness to the shippers and the transportation company. In making this statement we do not wish to be understood as criticisng or casting any reflection upon those who now constitute the commission. We believe the task is too large for any one body of men.

"Furthermore, it removes this power too far from the people. If the bill is enacted into law it will destroy all competition between the railroads. We have succeeded as manufacturers because the transportation companies interested in our business have been able and willing to transport our products to the markets of this and other countries at rates which have enabled us to meet competition. We cannot look with favor upon any scheme that will tie their hands.

"Our relations with the transportation companies are satisfactory. We have always found them willing to respond to any reasonable demand we have made upon them. Competition has resulted in excellent service, which is a valuable feature. We believe the wrongs complained of by certain classes of shippers are more imaginary than real."

Where Officers Pay Fare.

In the Prussian Diet a deputy of the kind which loses no opportunity to champion the workingman urged a reduction of passenger fares, such as the Minister had opposed, and said that it was natural that the State Railroad employes should take little interest in such a reduction, since they travel free. Thereupon the Minister of Public Works neatly wound him up by showing that he himself and the other officials of the Ministry have to buy their tickets when they travel just like common mortals, workingmen or other. By the way, it might be edifying for some thousands of American railroad officers and still more for some hundreds of thousands of other Americans, members of legislatures, aldermen, policemen, unofficial politicians with a pull, judges, Congressmen, editors, reporters, and their families, etc., to see the Prussian Minister of Public Works, who manages the largest railroad system in the world, buying his railroad ticket.

Railroads in Cuba.

Sir William Van Horne, Gen. Grenville M. Dodge and Gen. Samuel Thomas had a conference lately with the Secretary of War regarding a plan for a railroad in Cuba from Cape Antone on the extreme western coast to Cape Maisi on the extreme eastern coast of the island, a distance of about 760 miles. The purpose of the conference with Secretary Root was to lay before him the plans of the railroad syndicate and secure a permit to purchase the right of way. Secretary Root informed them that the United States had no authority to make any concessions or to grant any franchises or rights of way. He said that such a permit would have to come from the people of Cuba. He thought it probable that as soon as the municipal governments perfect an organization permits for rights of way could be secured from the municipalities through which the railroad would pass. If this cannot be done the railroad syndicate will probably have to wait until the organization in the island of the Cuban Government, which would have authority to make any concessions or grant any rights of way.

The Government as a Carrier.

The overwhelming defeat in the House of Representatives of the bill for reforming the postal service furnishes additional evidence of the incapacity of government to conduct business on business principles. The postoffice is a source of revenue in most countries, but in our own it has always been operated at a loss, and a loss much greater than is represented in the official returns. The department never charges itself with rent for the quarters which it occupies in government buildings, or with interest on its plant. The deficiency is made up by taxation, so that there is no truth in the claim that the government gives the people something for nothing. It gives the publishers and some others practically free transportation, and may be truthfully said to subsidize the press of the whole country. Second-class matter is in bulk 56 per cent. of the mail, it costs for transportation alone $24,000,000, and at a reasonable estimate, many millions more for handling, while it pays $3,500,000. It is said that two tons of a notorious play, the representation of which has been prohibited in New York as demoralizing, were lately distributed by the government through the mail at the expense of the public.—New York Evening Post.

American Couplers in Prussia.

In the Reichstag during a debate on the management of State railroads, the Prussian Government was severely taken to task on the subject of the antiquated system of coupling in use in Prussia. The Prussian Minister of Railroads, replying to criticism, said the Government had heard of the satisfactory experiments on the Bavarian railroads with the American automatic coupling, and would agree to undertake similar experiments during the coming summer.

The Western Strike Situation.

At Cleveland last week the machinists at more than 50 shops struck for a nine-hour day with the same pay as for ten hours. About 1,800 machinists, both union and non-union men, are out, not including men of other trades thrown out of work by the strike. Strikes are now in effect in Cleveland, Columbus and Chicago. At Chicago efforts have been made to reach a settlement of the strike by conferences between representatives of the Metal Manufacturers' Association and the Machinists' Union, but so far without success. Meantime assaults on non-union workmen by strikers have become of almost daily occurrence in Chicago. Several such assaults have occurred on Mar. 24, in one case within a block of a police station, but without interference on the part of the police. Seventeen firms in Cleveland have granted the nine-hour day with ten hours' pay, as demanded.

Chicago River Tunnels.

The Chicago City Council has passed the ordinances requiring the street railroad companies to lower at their own expense the LaSalle St., Van Buren St. and Washington St. tunnels under the Chicago River, so that water shall be from 21 ft. to 22½ ft. deep over their roofs. The work must be completed by March 1, 1901.

Technical Schools.

Columbia University.—On Thursday, March 22, Mr. Foster Crowell, Consulting Civil Engineer, delivered before the Engineering Society an interesting lecture on "Railroad Reconstruction without Disturbing Traffic," illustrated by lantern slides.

LOCOMOTIVE BUILDING.

The Gulf & Brazos Valley has bought one locomotive from F. M. Pease.

The Kaiser Ferdinand Northern, of Austria, has asked bids on 27 locomotives.

The Illinois Central is getting bids on 30 locomotives with option on 30 more.

The Somerset has ordered one engine from the Manchester Locomotive Works.

The Sharon Steel Co. is having one engine built by the Baldwin Locomotive Works.

The Union Pacific is having five engines built by the Schenectady Locomotive Works.

The Gainesville & Gulf has ordered one locomotive from the Baldwin Locomotive Works.

The Bethlehem Steel Co. has ordered one engine from the Baldwin Locomotive Works.

G. O. Braniff & Co. have ordered two locomotives from the Baldwin Locomotive Works.

The Lexington & Eastern has ordered one locomotive from the Baldwin Locomotive Works.

The Chicago, Milwaukee & St. Paul on March 27 ordered 32 locomotives from the Baldwin Locomotive Works.

The Chicago, Indianapolis & Louisville is said to be considering ordering a few more locomotives, probably switchers.

The Chicago Great Western is said to be considering about 25 locomotives in addition to the 16 noted in our issues of March 9 and 16.

The St. Louis & San Francisco is again considering ordering new locomotives. The matter was discussed in December last, when it was expected 10 or 12 engines would be ordered.

The Chicago & Eastern Illinois received bids on Mar. 27 on five two-cylinder compound 12-wheel locomotives with modified Wootten fireboxes, for delivery early next winter.

The Chicago, Burlington & Quincy has ordered from the Baldwin Locomotive Works three more Vauclain four-cylinder compound locomotives like the one ordered some time ago which is now used in fast passenger service.

The Belgian State Railroads have ordered 12 mogul engines, with 18 in. x 24 in. cylinders, from the Baldwin Locomotive Works. They will be similar to those recently built by the same works for the Great Northern of England. The engines are to be delivered by Nov. 6.

CAR BUILDING.

The Chicago & Eastern Illinois will probably order 150 more coal cars.

The Pacific Express Co. has ordered 10 refrigerator cars fom F. M. Pease.

The Kaiser Ferdinand Northern, of Austria, has asked bids on 900 freight cars.

The Ohio River has ordered 30 dump cars from the American Car & Foundry Co.

The Mather Stock Car Co. has ordered 10 cars from the Mt. Vernon Car Mfg. Co.

The Atlantic Coast Line will, it is reported, this week order 350 ventilated box cars.

The Produce Shippers' Dispatch has bought 200 refrigerator cars from F. M. Pease.

The Mexican Central is preparing specifications for new equipment to be ordered after May 1 by its Boston office.

The Cleveland, Cincinnati, Chicago & St. Louis has ordered 350 freight cars from the American Car & Foundry Co., to be built at St. Louis.

The Chicago, Milwaukee & St. Paul is placing orders for materials for 1,000 more box cars to be built late in the summer at its West Milwaukee shops.

The Chicago, Lake Shore & Eastern has ordered the 150 steel drop bottom gondola cars, referred to March 9, from the Pressed Steel Car Co. They will be of 100,000 lbs. capacity.

The Texas & Pacific has ordered 200 cars from the American Car & Foundry Co. in addition to the 650 referred to last week. These, with the 400 for the International & Great Northern, make a total of 1,250 in all ordered by the Texas & Pacific.

The Belgian State Railroads have asked bids on 40 passenger cars to be fitted with Westinghouse air brakes and apparatus for heating the cars and lighting them by gas. In our issue of Feb. 16 we noted the fact that the road was in the market for 2,000 freight cars and some passenger cars.

The Vandalia is having 350 coal cars of 80,000 lbs. capacity built by the American Car & Foundry Co., as noted Mar. 2. These cars will be 33 ft. 7 in. long, 8 ft. 11 in. wide, and 3 ft. 8 in. high.; weigh about 32,500 lbs.; will have Pennsylvania standard trucks, cast iron wheels, forged steel axles, cast steel bolsters, cast iron brake shoes, Westinghouse air brakes, National Hollow brake beams, Janney couplers, Phosphor-Bronze brasses, Graham draft rigging and cast iron journal boxes with pressed steel lids.

The Wabash on Mar. 22 ordered from the American Car & Foundry Co. the 3,000 box and 500 gondola cars noted in our issue of last week. They will be built at the St. Louis works. The specifications call for Westinghouse brakes, Universal bearings, Gould couplers, Dunham doors and Hutchins roofs. American Steel Foundry Company's bolsters will be used on 1,100, Simplex bolsters on 1,100 cars and Shickle Harrison & Howard bolsters on 1,000, and trucks and bolsters of other makes on the remaining 300 cars, on part of which the Kindl truck is specified.

BRIDGE BUILDING.

ALBUQUERQUE, N. M.—It is stated that a viaduct is in contemplation at Coal Ave., over the Santa Fe Pacific tracks.

ATWOOD, ONT.—T. Fullarton, Clerk of Elma Township, wants bids with plans and specifications, until April 9, for two steel bridges over the Maitland River.

BELFAST, ME.—Mayor Clarence O. Poor has recommended a new bridge built to East Belfast.

BOSTON, MASS.—The United States Senate has passed the bill authorizing the Boston Bridge Commission to build a bridge across the Charles River without a draw.

The Board of Harbor & Land Commissioners gave a hearing March 28 in Boston, on the petition of the Massachusetts Highway Commission for permission to rebuild bridges over the Pines River between Saugus and Revere.

BRADFORD, PA.—The proposed Buffalo branch of the Pennsylvania RR. will need a steel viaduct about 500 ft. high and about 3,000 ft. long near Bradford.

CALIFORNIA, OHIO.—Bids are wanted by the Commissioners of Water-works, at Cincinnati, O., until May 4, for the superstructure of a steel truss bridge as mentioned in our advertising columns. Aug. Herrmann, Pres.; Charles G. Roth, Clerk.

CAPE GIRARDEAU, MO.—The Southern Missouri & Illinois Ry. & Bridge Co., recently chartered in Missouri, will build a bridge over the Mississippi River. See Railroad Construction column.

CHICAGO, ILL.—The budget for 1900 contains an appropriation of $1,250,000 for new bridges to replace those at Ninety-fifth St., Clyburn Place, Division St. over the canal and Division St. over the Chicago River, Archer Ave., South Western Ave. and Thirty-seventh St.

Bids will soon be asked, and opened June 1, it is said, for a bridge over the Ogden Canal at Davison St. It is understood that a bridge to cost about $200,000 is wanted, and that the street railroad company will pay about one-half the cost.

CLARKSVILLE, IA.—The Chicago Great Western bridge over Shell Rock River near this place was reported destroyed on March 14.

CLEVELAND, O.—The City Council has taken steps to issue $300,000 of bonds for a viaduct and bridge over the Cuyahoga River on Clark Ave., connecting Jennings Ave. with Petrie St.

COLUMBUS, O.—The Columbus, London & Springfield (electric) Ry. will need a number of steel bridges on the proposed line. H. A. Fisher, General Manager.

DARBY, PA.—The Philadelphia, Morton Swarthmore and the Chester Traction companies propose to build a new bridge over Darby Creek at a cost of about $30,000.

DELAWARE, O.—The following are the bids received March 16 for a three-span bridge over the Oleantangy River:

Toledo Bridge Co., Toledo, O.	$21,600
King Bridge Co., Cleveland, O.	21,800
Bellefontaine Bridge & Iron Co., Bellefontaine, Ohio	21,869
Youngstown Bridge Co., Youngstown, O.	21,912
Massillon Bridge Co., Massillon, O.	22,000
Wrought Iron Bridge Co., Canton, O.	22,000
Illinois Bridge Co., Chicago, Ill.	22,100
O. C. Herring, Columbus	22,076
Mt. Vernon Bridge Co., Mt. Vernon, O.	22,181
Bracket Bridge Co., Cincinnati, O.	22,500
Lafayette Bridge Co., Lafayette, Ind.	22,700
Canton Bridge Co., Canton, O.	22,850
New Castle Bridge Co., New Castle, Ind.	22,975
Variety Iron Works Co., Cleveland, O.	23,100
Cincinnati Bridge Co., Cincinnati, O.	23,150
Horseheads Bridge Co., Horseheads, N. Y.	23,200
S. E. Maxfield, Milwaukee, Wis.	23,600
Champion Bridge Co., Wilmington, O.	23,700
Oregonia Bridge Co., Oregonia, O.	24,000

DETROIT, MICH.—City Engineer McCormick's estimate for eliminating railroad grades according to the city's plans are as follows: Excavation, $464,699; excess of embankment over excavation, $655,034; retaining walls, $440,012; structures, 119, at $30,000 each, $3,570,000; ballasting, $107,200; steel trestle, $294,900; engineering and contingent expenses, $100,000.

GRAND FORKS, N. D.—Bids are wanted until April 3 for all bridges required for Grand Forks

County during the fiscal year ending April 1, 1901. J. W. Scott, County Auditor.

GRAND RAPIDS, MICH.—An election will be held April 2, to consider spending $20,000 for the two bridges recently mentioned, one near Plainfield and the other at Ada.

HARTFORD, CONN.—The Central New England, according to report, contemplates building several steel bridges to replace wooden structures, including that over the Housatonic River.

HUMBERSTONE, ONT.—The specifications for proposals for a highway swing bridge for which bids were wanted March 23, have been changed. The time for receiving bids for the substructure is March 31, and the superstructure April 15. L. K. Jones, Secretary, Department of Railways & Canals, Ottawa.

JERSEY CITY, N. J.—Bids are wanted April 15 for a new steel bridge over the Pennsylvania Railroad cut at Baldwin Ave., Jersey City. John P. Egan, Clerk of the Board of Chosen Freeholders of Hudson County.

JOPLIN, MO.—The Kansas City, Pittsburgh & Gulf, according to report, is considering altering the viaduct over the railroad yards at Third St. Estimated cost, $10,000.

MALVERN, ARK.—The bridge commissioners of Hot Springs County on March 22 let the contract for building an iron bridge across Ouachita River, near Malvern, to Stup Brothers Bridge Company, St. Louis, Mo. The contract price is $26,000.

NEW YORK CITY, N. Y.—A bill has been introduced in the New York Senate providing for altering the width of the drawbridge over the Harlem River between 145th St. and 147th St.

NOTTINGHAM, O.—Bids are wanted until April 7 for a 58-ft. steel bridge for Cuyahoga County. Julius C. Dorn, Clerk, Cleveland, O.

OTTAWA. ONT.—The County Council will issue about $15,000 of bonds to build bridges.

PHILADELPHIA, PA.—The plans and specifications for the completion of the new bridge across the Schuylkill at Gray's Ferry have been finished, and proposals for the work will soon be asked.

PORTAGE LA PRAIRIE, MAN.—A site has been selected by the Provincial Public Works Department for the proposed bridge over the Assiniboine River. An appropriation of $18,000 has been made to the work by the Manitoba Government.

PORT HURON, MICH.—The Pere Marquette RR., according to report, will bridge the Black River at this place.

RUMFORD FALLS, ME.—Bids are wanted April 20 by the Portland & Rumford Falls Ry. for a concrete bridge.

ST. JOSEPH, MO.—The Chicago Great Western, according to report, has plans prepared for a steel viaduct at the Fifth Ave. crossing.

SOUTHAMPTON (L. I.), N. Y.—The Long Island RR. has made a preliminary survey for abolishing the grade crossing, which will require a bridge at this place.

STOCKTON, CAL.—Two steel bridges about 80 ft. wide, estimated to cost about $13,000, are under consideration by San Joaquin County. Bonds have been ordered issued. G. A. Atherton, County Surveyor.

SYDNEY, NEW SOUTH WALES.—We have already mentioned in this column that the Government of New South Wales wants bids until Aug. 1, 1900, for a highway and railroad bridge across Sydney Harbor. The width across the harbor is 1,180 ft., and the height of the bridge is to be 180 ft. above sea level. It is stated that if no bids are accepted, premiums of £1,000 and £500 respectively will be given for the two best designs submitted. Messrs. R. W. Cameron & Co., 23 South William St., New York City, can give further particulars.

TERRAL, I. T.—The Chicago, Rock Island & Pacific is adding three 200-ft. spans to the present bridge over the Red River at this place, these spans taking the place of pile and trestle bridge. This will make the entire metal structure eight spans, with a total length of 1,600 ft. (March 23, p. 192.)

THE DALLES, ORE.—The bridge proposed across the Columbia River near this place will be built by the Columbia Valley Ry. Co. It will be about 170 ft. long and cost about $200,000. L. Gerlinger, President.

TOLEDO, O.—A bill has been introduced in the Ohio Legislature which provides that the location for the proposed bridge over the Maumee River in Toledo shall be determined by popular vote. This bridge will cost about $500,000.

The Cherry St. bridge is to be widened and strengthened, according to report.

WASHINGTON, D. C.—In the District of Columbia appropriation bill, now before Congress, an appropriation of $50,000 is made toward the bridge proposed across Rock Creek on the line of Connecticut Ave. extension.

WATERLOO, IA.—We are told that the Illinois Central does not contemplate building a viaduct over the Des Moines River at Waterloo, as reported.

WEAVERVILLE, CAL.—The Board of Trinity County Commissioners have under consideration plans for a 180-ft. bridge. H. C. Ingram, County Surveyor.

WILLIAMSPORT, PA.—The Commissioners of Lycoming County have been petitioned for a new bridge across the Susquehanna River which will be about 1,000 ft. long. The county has under consideration several other bridges for this year.

Other Structures.

BRISTOL, TENN.-VA.—The Virginia Iron, Coke & Coal Co. has submitted plans to the city officers for its proposed buildings in that city, comprising the following: A bar and horseshoe plant, with building 100 x 800 ft.; a puddling plant, 100 x 200 ft.; a rolling-mill, 100 x 700 ft.; machine shops, 100 x 304 ft.; foundry, 100 x 192 ft.; two buildings for boiler shops, one 50 x 80 ft. and the other 50 x 100 ft.; car shops, 50 x 125 ft.; casting shed, 48 x 100 ft.; round-house over 200 ft. in diameter; general office building; railroad depot and various minor buildings; two railroad yards, containing 15 tracks.

BUFFALO, N. Y.—The New York Central & Hudson River has let a contract for building an ore dock 620 ft. long at Buffalo.

CHICAGO, ILL.—The Ritter-Conley Mfg. Co. of Pittsburgh has the contract for a 400-ton blast furnace plant for the Iroquois Iron Co. at South Chicago, to cost about $500,000.

DES MOINES, IA.—John Volt of Rock Island, Ill., has the contract for the new Chicago, Rock Island & Pacific depot in Des Moines.

DEROIT, MICH.—The Pittsburgh Bridge Co. has a contract from the Solvay Process Co. of Syracuse, N. Y., for building and partial equipment of a building for a plant, at Detroit. Cost, $90,000.

DULUTH, MINN.—A contract has been let to C. F. Haglan of Minneapolis for an addition to the Pevey grain elevator at Duluth. It will have concrete bins and is to be completed by Sept. 15.

GODERICH, ONT.—The Grand Trunk Ry. proposes to build a new passenger station at this place some time during the spring.

KANSAS CITY, MO.—Fire on Mar. 27, in the plant of the Kansas City Car & Foundry Co., located on the Kansas side of the river near Argentine, caused a loss estimated at $150,000. The plant is valued at $500,000.

McKEES ROCKS, PA.—The new plant of the Pennsylvania Malleable Steel Co. at this place has been put in operation. The plant covers five acres. The power will be furnished by six 65-h. p. gas engines connected with dynamos. The main building will be 640 ft. long and 220 ft. wide, and will be of steel frame. The pattern shop and storage wareroom will be a brick building 140 ft. long and 60 ft. wide, and the power house will be a brick structure, 120 ft. x 60 ft. The plant will have an annual output of between 25,000 and 30,00 tons.

The Pennsylvania Malleable Steel Company is capitalized at $600,000. Geo. S. White is President and D. O. Holbrook is secretary and treasurer. A large percentage of the output will be taken by the Pressed Steel Car Co.

MINNEAPOLIS, MINN.—W. W. Eastman, James E. York, A. H. Linton, H. C. Henry, W. J. Vandyke and others of Minneapolis have incorporated the Ashland Iron & Steel Co. under the laws of Wisconsin, with a capital stock of $250,000. The company proposes to mine and sell iron ore and make pig iron, steel, etc.

NEW LONDON, CONN.—The Central Vermont Railroad's freight house on the water front, and about 25 freight cars, were destroyed by fire March 23.

RICHMOND, VA.—Doyle & Doak, of Philadelphia, have invited bids on the passenger station to be built here by the Chesapeake & Ohio, and the Seaboard Air Line. Wilson Bros. & Co., of the Drexel Building, Philadelphia, have completed the plans, which call for a four-story steel frame structure, fireproof, granite front, to cost about $300,000.

ROANOKE, VA.—J. J. Garry has the contract for a 72 x 139 ft. building at Roanoke, for the Norfolk & Western, to be used as a frog and switch shop replacing the shops formerly at Shenandoah.

WESTWEGO, LA.—The Texas & Pacific is receiving bids for a 500,000 bushel elevator at this place.

WINNEPEG, MAN.—The Canadian Pacific, according to report, wants bids for building its proposed new hotel and station at Winnipeg. The cost of this work and other proposed terminal improvements was estimated in the last annual report at $700,000.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xii.)

Canadian Society of Civil Engineers.

At the meeting on Thursday of this week, the last lecture of the course on "The Transmission of Electrical Power," was delivered by Professor R. B. Owens, M. Can. Soc. C. E.

American Institute of Electrical Engineers.

The 141st meeting of the Institute was held at 12 West 31st St., New York City, on Wednesday evening of this week. A paper was presented by Mr. Joseph Sachs on "The Evolution of Safe and Accurate Fuse Protective Devices." Eighteen associate members were elected to membership.

Boston Society of Civil Engineers.

At the annual meeting of the Boston Society of Civil Engineers held on March 21, the following officers were elected: President, Alexis H. French; Vice-President, Frank W. Hodgdon; Secretary, S. Everett Tinkham; Treasurer, Edward W. Howe; Librarian, Louis F. Cutter; Director, Ira N. Hollis.

Western Society of Engineers.

At a meeting of the Western Society of Engineers, Chicago, Wednesday evening, March 21, Mr. Octave Chanute presented a paper on "Preservative Treatment of Timber." This paper reviewed briefly American experience with treated cross ties and gave much information about European practice collected during a recent trip abroad.

The Air-Brake Association.

The seventh annual convention of the Air-Brake Association, formerly the Association of Railroad Air-Brake Men, will be held in Jacksonville, Fla., April 3. It has been decided to allot space for displaying railroad supplies without cost to the exhibitor. The headquarters will be at the St. James Hotel where a special rate of $2.50 has been made for members.

Car Foremen's Association of Chicago.

The regular monthly meeting was held March 6, 64 members being present. Eighteen new members were added.

The first question discussed was, "Should Owners Be Charged for Turning Down a Tapered Journal?" There appear to be very few in freight service, the large majority being on passenger cars, due, principally, it was thought, to the construction of the truck. As tapered journals were possibly caused by running hot, by dust and dirt entering from the rear end, trucks being out of square, etc., it was thought that the circumstances in each particular case should govern as to responsibility.

"Is the Present M. C. B. Coupler More Destructive to Draft Rigging Than the Link and Pin Drawbar?" Engineers were blamed for handling cars more roughly, now that there were no men going between the cars; and the switchmen were blamed for giving the engineers the "high-ball" signal, in switching with the M. C. B. coupler. In this way the draft gear suffers more than with the old link and pin drawbar. But even with the rough switching there is less damage done to the draft rigging than formerly, owing to the coupler having a good buffing bracket, which strikes the end sill and takes the force of the shock. Also, heavier and stronger draft timbers are now applied.

In the discussion of broken king bolts, the engineers and switchmen were again charged with rough switching. From observations which had been made, however, it was found that the trouble was principally due to the old saucer shaped center plate, which allowed the car to slide off easily and break the center pin; and that with the introduction of the modern center plate, with a square shoulder, the trouble had been greatly lessened. The subject was continued.

The next meeting of the Association will be held April 12. The Secretary is Aaron Kline, 702 Maplewood Avenue.

PERSONAL.

(For other personal mention see Elections and Appointments.)

—Mr. Martin C. Parker, for a number of years General Freight Agent of the New Haven & Northampton, died March 24 at Northampton, Mass. He was born in Whately, Mass., in 1828, and began his railroad career as Agent on this same road in 1860.

—Mr. Edwin M. Humstone, at one time Assistant Superintendent and Master Mechanic of the Philadelphia, Reading & New England, now the Central New England, died March 20, at his home in Poughkeepsie, N. Y. He was born in Ulster County, N. Y., 56 years ago.

—Mr. J. O. Reed has been made Superintendent of the Pittsburgh, Johnstown, Ebensburg & Eastern, as we have already noted. Mr. Reed was born in Spring Valley, Pa., and began railroad work in 1882 as a bridge carpenter on the Huntington & Broad Top Mountain, on which road he also served for a number of years as car builder. He had four years' experience also as General Mechanic for the Powelton furnaces at Saxton. In 1898 he was made General Foreman of the P. J. E. & E., in which position he served until his appointment as Superintendent.

—Mr. A. H. Rudd, for several years past Signal Engineer of the Hartford Division of the New York, New Haven & Hartford, has been appointed Signal Engineer of the Delaware, Lackawanna & Western and will go to that road on April 1. His headquarters will be at Hoboken, N. J. Mr. Rudd is a well-known member of the Railway Signaling Club, having done important work in the committees of that Association. A series of articles written by him, discussing the organization of the Signaling Departments of railroads, is now running in the Railroad Gazette.

—Mr. L. H. Clarke, formerly for ten years Chief Engineer of the Lake Shore & Michigan Central, died at his home in Chicago on March 20, aged 70 years. Mr. Clarke was born in Massachusetts in 1830 and in 1852 was engaged in engineering work on the Illinois Central helping to make the preliminary survey. In 1860 he was appointed Chief Engineer of that road, which position he held until 1877, when he became Chief Engineer of the Lake Shore & Michigan Southern, being made Consulting Engineer in 1887. About one year ago he retired on account of ill health.

—Mr. H. C. Nutt, the new Assistant Superintendent of the Chicago, Burlington & Quincy at Burlington, Ia., was born at Council Bluffs, Nov. 12, 1863. He was graduated from the Sheffield Scientific School in 1883, and entered railroad service with the Burlington & Missouri River as rodman in August of that year. He has since been continuously with that company, holding various positions in the Engineering Department up to that of Resident Engineer until 1890, when he was appointed Trainmaster on the Wyoming Division. In 1892 he was made Assistant Superintendent of the same division, which position he held until his late appointment.

—Mr. John N. Abbott, for many years General Passenger Agent of the Erie Railroad, and subsequently for several years chairman of the Western States Passenger Association, has been chosen Vice-President and General Manager of the Consolidated Railway Electric Lighting & Equipment Company, of New York City. This company manufactures electric lighting apparatus for cars, refrigerating appliances and other railroad appliances. It is a consolidation of the American Railway Electric Light Company, United Electric Company, Columbian Electric Car Lighting & Brake Company, Electric Axle Light & Power Company and the European Railway Electric Lighting Company.

—Mr. G. T. Neubert, the new Division Master Mechanic of the Atchison, Topeka & Santa Fe at Newton, Kan., was born at Fort Wayne, Ind., April 6, 1860. He began the machinist's trade in the Union Pacific shops at Armstrong, Kan., in 1874, remaining there until 1880, when he took work as machinist with the Atchison, Topeka & Santa Fe at Topeka. Since that time he has served in similar capacities with the Union Pacific and the Kansas City, Fort Scott & Memphis, returning to the Atchison in 1892. He has remained with this company until now, serving as Foreman at Dodge City, Kan., and General Foreman at Nickerson, Kan., until June, 1893, and Division Master Mechanic of the Panhandle Division at Wellington, Kan., until 1897. He was then made Division Master Mechanic of the Oklahoma Division and has now had his jurisdiction extended over the Middle Division, with headquarters at Newton, Kan.

—Mr. H. Englebright, the new Master Car Builder on the Southern Pacific at Oakland, Cal., was born at Bedford, Mass., in 1856. When he was very young

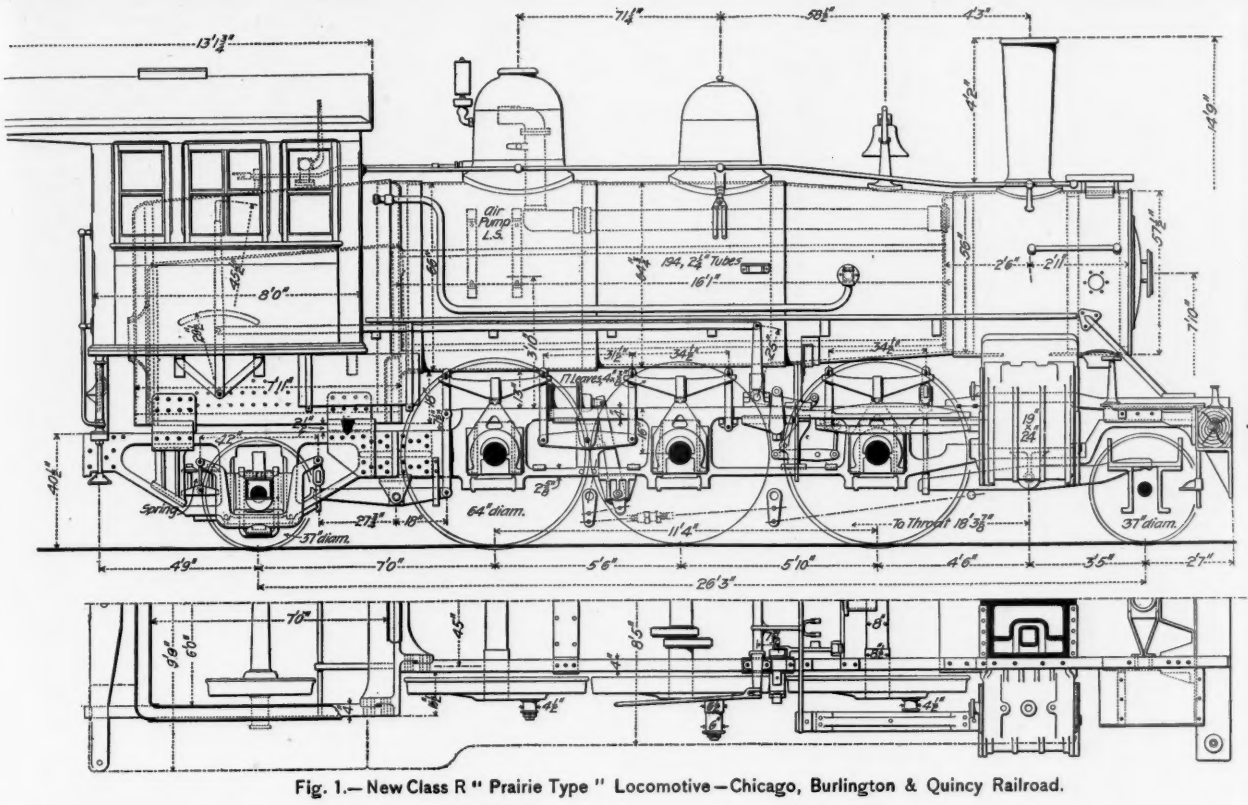


Fig. 1.— New Class R " Prairie Type " Locomotive—Chicago, Burlington & Quincy Railroad.

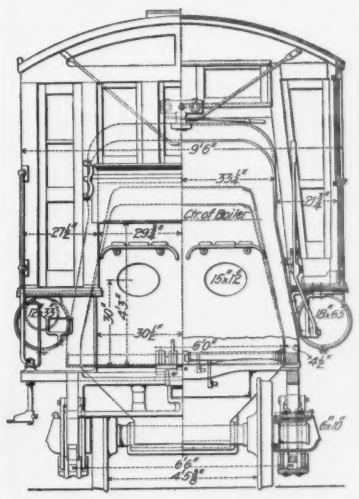
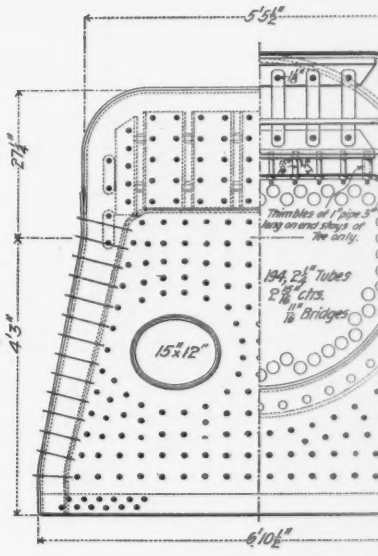


Fig. 2.—Sections, Class R Loc



Cross Section, Class R Bo

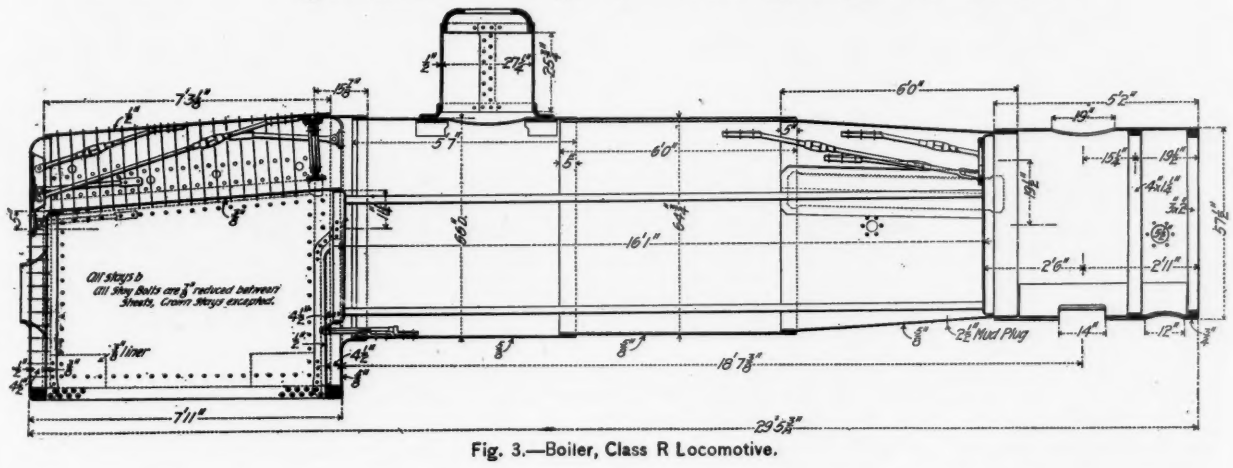


Fig. 3.—Boiler, Class R Locomotive.

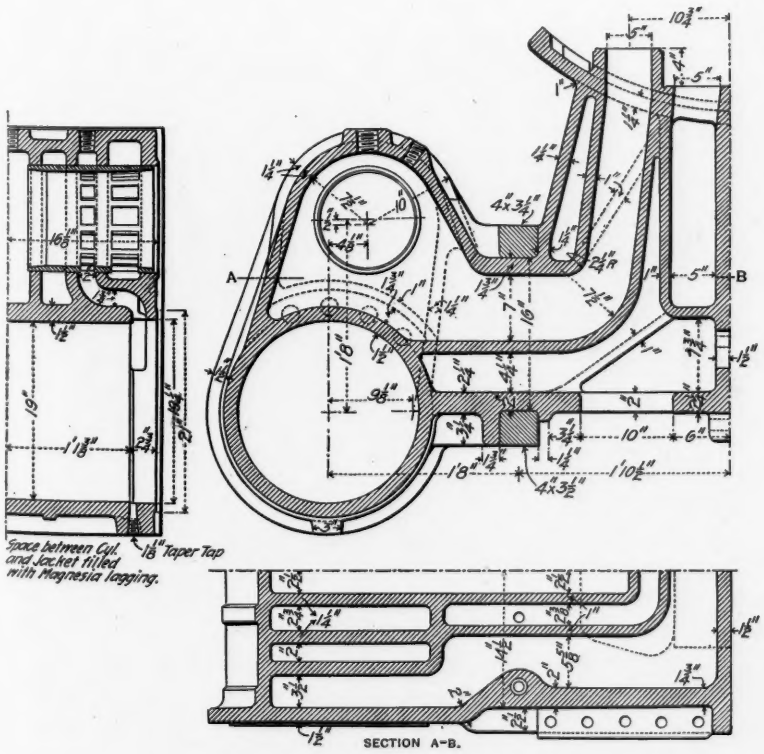


Fig. 4.—Cylinder, Class R Locomotive.

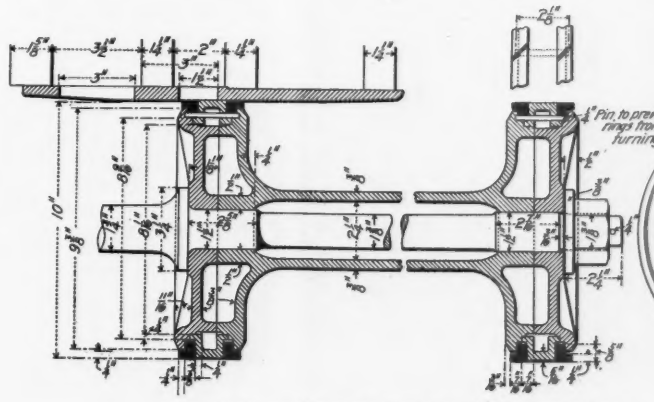
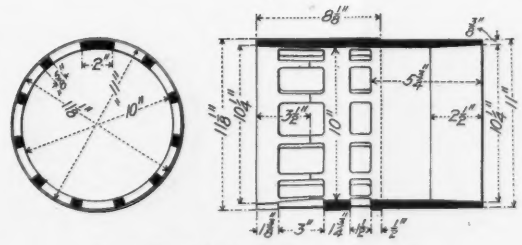
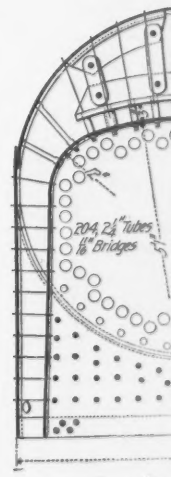


Fig. 5.—Piston Valves for Class R and G3 Locomotives.



Steam Chest Bushing, Class R Locomotive.



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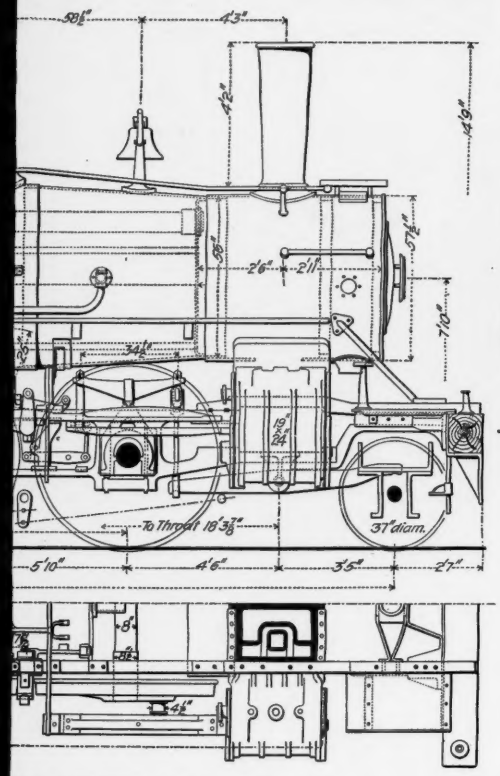
NEW CLASS R " PRAIRIE TYPE " LOCOMOTIVE, AND CLASS G3 SIX-WHEEL SWIT

Designed by MR. F. A. DELANO, *Superintendent of Motive Power, and* MR. F.



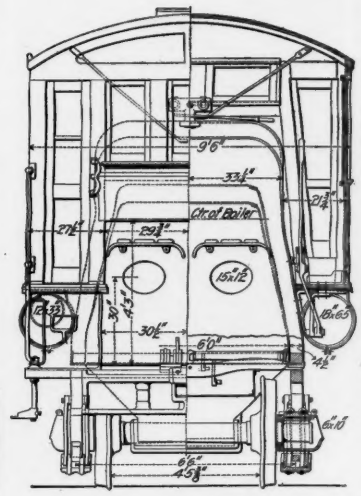
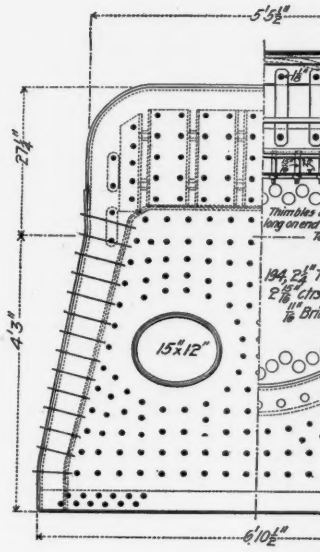
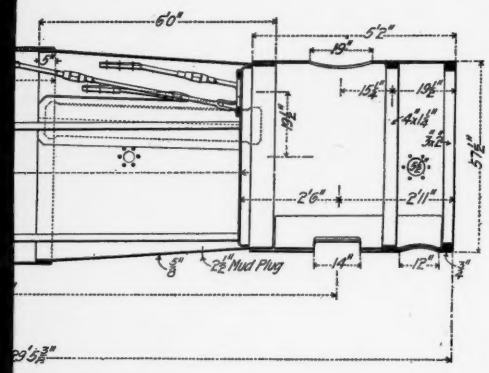


Fig. 2.—Sections, Clas

ago, Burlington & Quincy Railroad.



Cross Section, Class



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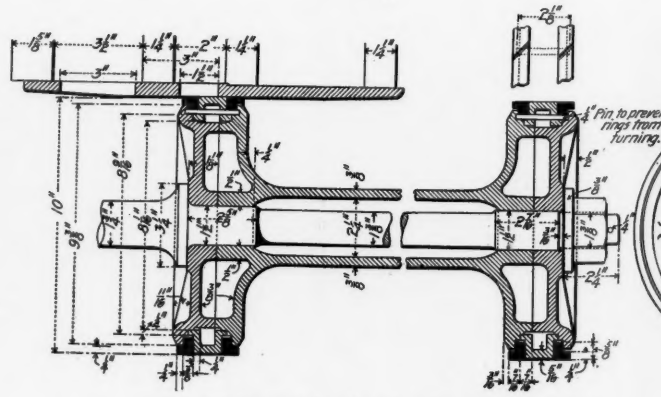
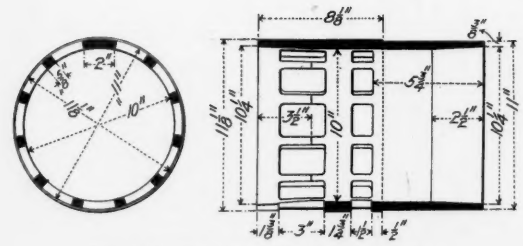
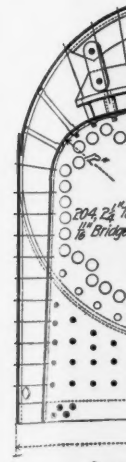


Fig. 5.—Piston Valves for Class R and G3 Locomotives.



Steam Chest Bushing, Class R Locomotive.



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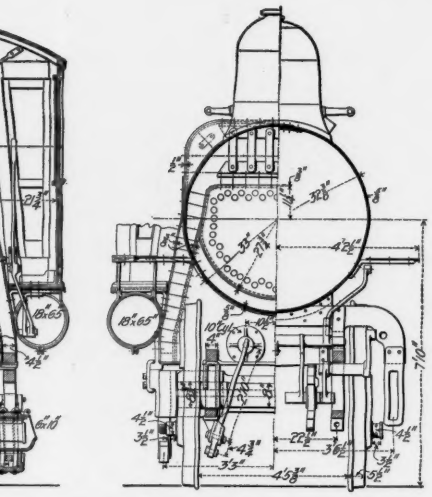
NEW CLASS R "PRAIRIE TYPE" LOCOMOTIVE, AND CLASS G3 SIX-WHEEL S

Designed by MR. F. A. DELANO, *Superintendent of Motive Power, and* M



ections, Class R Locomotive.

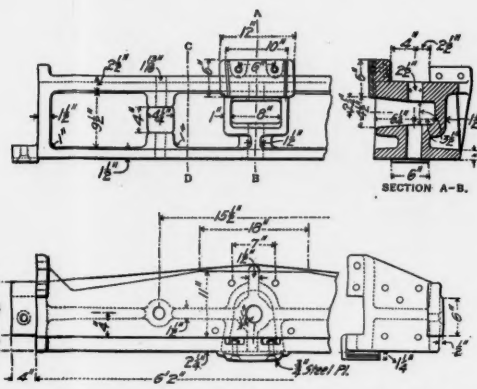
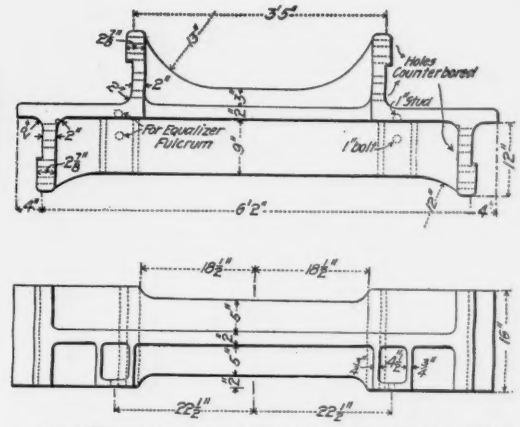
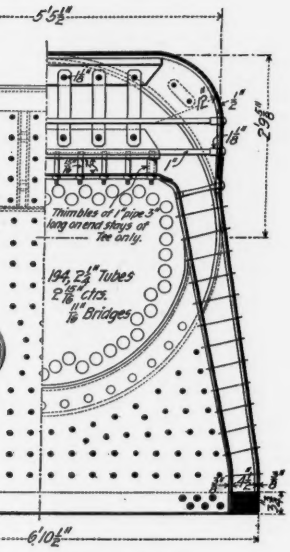


Fig. 6.—Rear Frame Cross Bar (Cast Steel)—Class R Locomotive.



Front Frame Cross Bar (Cast Steel)—Class R Locomotive.



Section, Class R Boiler.

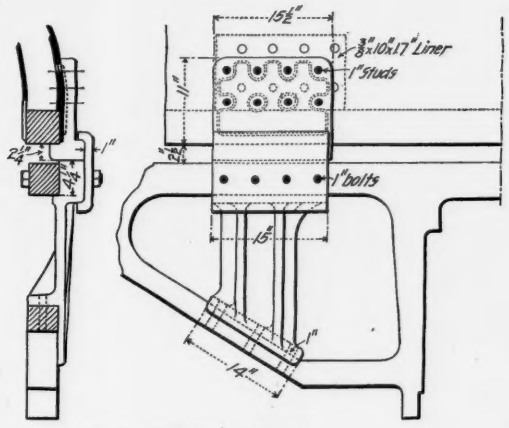


Fig. 7.—Rear Expansion Pad, Class R Locomotive.

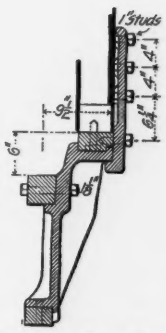


Fig. 10.—Front Expansion Pad, Glass G3 Locomotive.

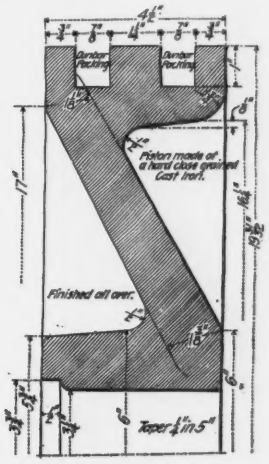


Fig. 11.—Piston, Class G3 Locomotive.

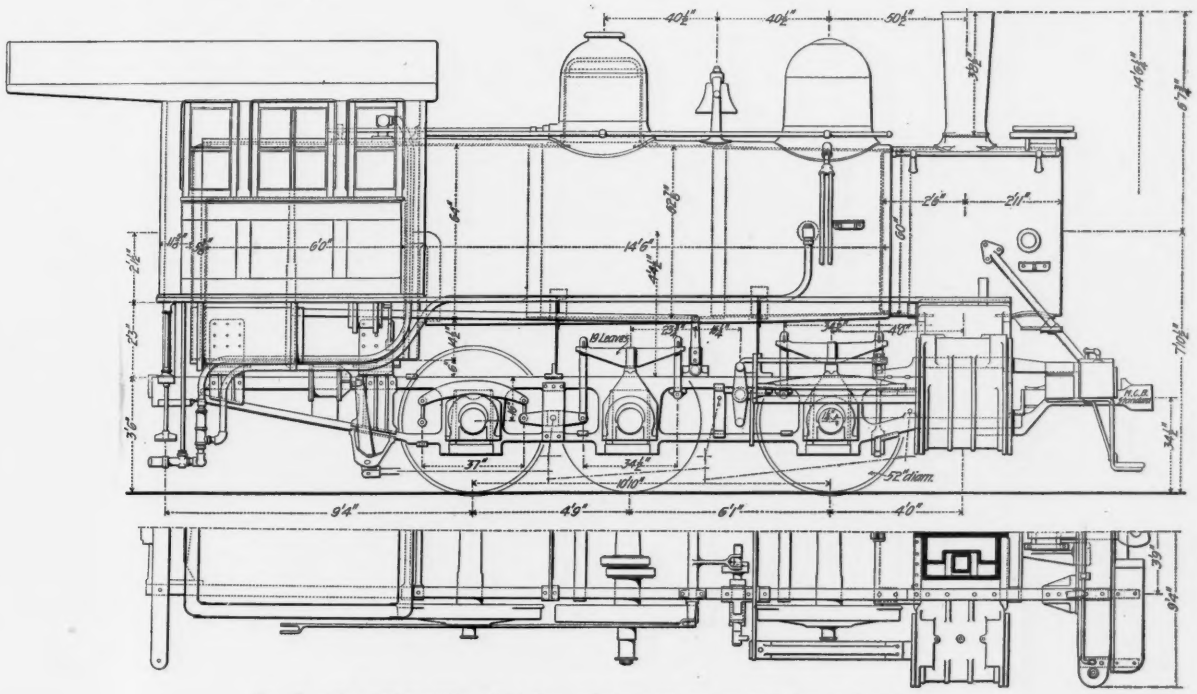
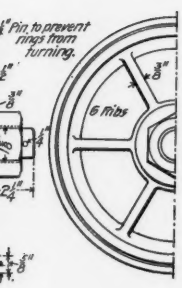


Fig. 8.—Class G3 Six-Wheel Switcher—Chicago, Burlington & Quincy Railroad.



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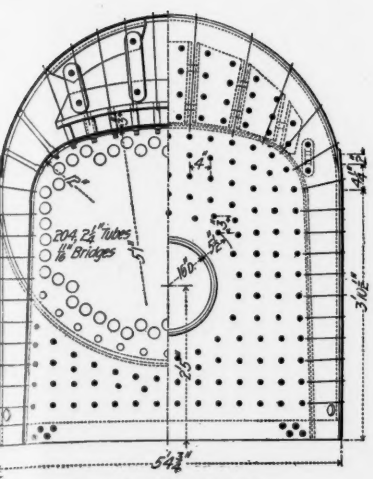

Gross Section of G3 Boiler.

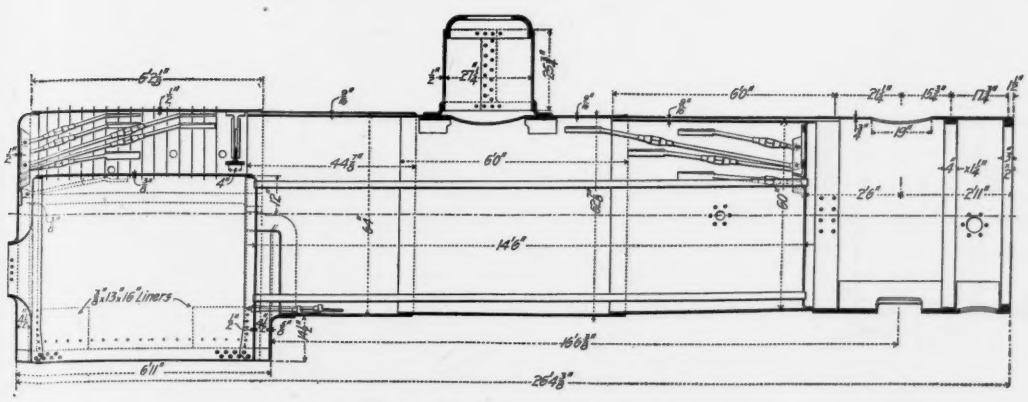

Fig. 9.—Boiler for Class G3 Switcher.

SIX-WHEEL SWITCHER—CHICAGO, BURLINGTON & QUINCY RAILROAD.

Power, and MR. F. H. CLARK, *Mechanical Engineer, C., B. & Q. RR.*

his parents moved to California, where he served an apprenticeship as a blacksmith in the shops of the old California Pacific, now a part of the Southern Pacific. Later he was employed by the North Pacific Coast RR. to aid in setting up machinery during its construction. After some years of service with the United States Government at Mare Island Navy Yard, he returned in 1877 to California, working with the Central Pacific in different capacities at Sacramento, San Francisco and Oakland. In 1891 he was sent to Fresno as foreman car repairer, and in 1893 became roundhouse foreman also. In August, 1898, he was transferred to San Francisco as foreman of the car shops and continued in that capacity until February of this year, when he was made Master Car Builder.

—Notice has been made of the appointment of Mr. A. L. Morgan as Engineer Maintenance of Way of the Cincinnati & Muskingum Valley line of the Pennsylvania Company at Zanesville, O. Mr. Morgan was born at Urbana, O., Sept. 19, 1866. He was graduated from the Scientific Department of Earlham College of Richmond, Ind., in 1888, and the following year took post-graduate work in the Engineering Department of the Ohio State University. He was transitman on various surveys for the Chattanooga Land & Railway Co., for several months in 1889, and Resident Engineer building streets and street railroads for the North Chattanooga Land Co. until July, 1890. He was then appointed Assistant Engineer of the Cincinnati & Muskingum Valley, continuing in that office until August, 1898, when he was placed in charge of double track work and grade reduction on the Pittsburgh Division of the main company. His recent appointment took effect March 1.

—Mr. W. H. V. Rosing has been appointed to the newly created office of Assistant Superintendent of Machinery of the Illinois Central. He was born in Cincinnati, O., March 8, 1859. After leaving the Institute of Technology of Boston in May, 1880, he entered railroad service with the Illinois Central as machinist's helper at the old Weldon shops, Chicago. Except for brief periods between 1891 and 1897, he has been with the Illinois Central until the present time. He was transferred to the draughting room in April, 1882, and became Secretary to the Superintendent of Machinery in September of the same year; Chief Draughtsman of the Machinery Department in January, 1884, and Assistant Master Mechanic of the Chicago Division in April, 1890. After serving as Mechanical Engineer of the Grant Locomotive Works in 1892, and Master Mechanic of the First Division of the Denver & Rio Grande in 1894, he returned to the Illinois Central in 1897 as Mechanical Engineer, and took his present position on Dec. 1 last.

—The General Manager of the reorganized Kentucky & Indiana Bridge Co., Mr. B. S. Josselyn, has been in railroad service since June, 1872. He was born Feb. 7, 1853. He served for two years as bill clerk and telegraph operator with the Illinois Central. For the following two years he was brakeman on the Kansas Pacific and the Missouri River, Fort Scott & Gulf (Kansas City, Fort Scott & Memphis). For three years following 1876 he was telegraph operator with the Burlington, Cedar Rapids & Minnesota, and then with the Chicago, Rock Island & Pacific. Most of the following eight years was spent with the Union Pacific as agent at Grand Island, Neb., and then as Superintendent's clerk and stationer. For four years from October, 1887, he was Chief Train Dispatcher and Car Accountant of the Denver & Rio Grande. On Jan. 1, 1893, he was made General Manager of the Kansas City, Osceola & Southern. After holding this position for nearly six years, he became General Superintendent of the Omaha & St. Louis and the Omaha, Kansas City & Eastern. He entered his present position on Feb. 1 last.

—Mr. Frank H. Britton, as already noted, has been made General Manager of the St. Louis Southwestern. Mr. Britton was born Nov. 29, 1850, at Ovid, N. Y. He entered railroad service in August, 1868, as a telegraph operator on the Michigan Southern & Indiana Northern. He entered the telegraph department of the Chicago & Northwestern in June, 1869, and became Assistant Train Dispatcher of the Louisville & Nashville at Clarksville, Tenn., in November, 1871. He continued with that road until 1882 as Chief Train Dispatcher on the South & North Alabama Division from 1874; Trainmaster on the same division from February, 1879, and as Trainmaster on the Mobile & Montgomery and the Mobile and Selma divisions from 1880. For several months following June, 1882, he was Superintendent of Transportation on the Chesapeake, Ohio & Southwestern at Louisville, Ky. He then took a similar position on the Chicago Division of the Baltimore & Ohio and was advanced to Superintendent of the same division on Jan. 1, 1886, holding that place for five years. For a year following June, 1893, he was General Superintendent of the Minnesota & Wisconsin, when he entered the service of the Great Northern as Superintendent of the Montana Division from September, 1894, to December, 1895, and of the Fergus Falls Division to March, 1898, when he was made Assistant General Superintendent in charge of the Western District, with headquarters at Spokane, Wash. In November, 1898, he was transferred to the Dakota Division, with headquarters at Larimore, N. D., which position he held at the time of his recent transfer.

ELECTIONS AND APPOINTMENTS.

Austin & Northwestern (Southern Pacific).—At a meeting of the stockholders held March 21, W. R. Hambry was elected Treasurer; C. R. Reilly, Secretary.

Central Traction Company of Indiana.—The officers of this company, referred to in the Construction column, are: President, William L. Kann, 717 Grant St., Pittsburgh, Pa.; Vice-President and General Manager, Charles A. Ford, Kokomo, Ind.; Secretary, George Lilly, Anderson, Ind.; Treasurer, Horace C. Stilwell, Anderson, Ind.

Chicago & Alton.—D. C. Morgan has been appointed Engineer Maintenance of Way, with headquarters at Kansas City, Mo.

Chesapeake & Ohio.—T. S. Lloyd, Division Master Mechanic at Richmond, Va., has resigned. The headquarters of J. F. Orndorff, Assistant General Freight Agent, have been removed from Cincinnati, O., to Richmond, Va.

Cleveland, Cincinnati, Chicago & St. Louis.—L. L. Hyde, Assistant General Freight Agent, having resigned (p. 193), the duties of that office will on April 1 be divided with W. G. Reynolds, in charge of the Tariff Bureau. F. P. Boisseau will be in charge of the Claim Department.

W. J. Long, Supervisor of Track at Terre Haute, Ind., and Geo. Klump, Supervisor of Bridges and Buildings at Mattoon, Ill., have resigned. Effective April 1.

Cumberland Railway & Coal Co.—At a recent meeting of the stockholders J. R. Cowans was elected President and G. A. Cowans General Manager.

Delaware, Lackawanna & Western.—T. S. Lloyd, heretofore Division Master Mechanic of the Chesapeake & Ohio at Richmond, Va., has been appointed Superintendent of Motive Power and Machinery, with headquarters at Scranton, Pa., succeeding John W. FitzGibbon, resigned.

Halifax & Yarmouth (Coast Ry. of Nova Scotia).—Robert Woodburn has been appointed Master Mechanic, with headquarters at Yarmouth, N. S.

Hot Springs.—On account of ill health L. D. Richardson, General Superintendent, has been relieved from active duty on full pay. F. A. Bill, Auditor and General Passenger and Freight Agent, will assume the duties of that office until Mr. Richardson's health is sufficiently improved for him to resume his position.

Jalapa & Cordova.—E. A. Marr, Traffic Manager at Jalapa, Mex., has resigned.

Macon, Dublin & Savannah.—At a meeting of the stockholders A. C. Soper of Chicago was elected President.

New York Central & Hudson River.—George Klump, heretofore Supervisor of Bridges and Buildings of the Cleveland, Cincinnati, Chicago & St. Louis, has been appointed Supervisor of Bridges of the N. Y. C. & H. R., with headquarters at Rochester, N. Y., succeeding J. P. Lyons.

Panhandle & Gulf.—The officers of this company referred to in the Construction column are: President, A. E. Stillwell, Kansas City, Mo.; Vice-President, J. R. Daugherty, Sweetwater, Tex.; Treasurer, R. L. McCaulley, Sweetwater; Secretary, J. P. Trammell, Sweetwater.

Pennsylvania.—It is stated that U. S. Houck, heretofore Superintendent of the Pittsburgh, Johnstown, Ebensburg & Eastern, has taken a position in the Engineering Department of the P. RR., at Altoona, Pa.

Philadelphia & Reading.—C. M. Lewis has been appointed Superintendent of Telegraph, with headquarters at Reading, Pa., succeeding L. Horton, Jr., resigned. Effective April 1.

Philadelphia, Wilmington & Baltimore.—Gamble Latrobe, heretofore Supervisor at Washington, D. C., has been transferred to Wilmington, Del., as Supervisor succeeding A. H. Tinges, deceased.

St. Louis Southwestern.—W. N. Neff, heretofore Assistant Division Superintendent of the Great Northern at Kalispell, Mont., has been appointed Superintendent of the S. L. S., with headquarters at Pine Bluff, Ark., succeeding R. H. Bowron. C. G. Langston has been appointed Assistant General Master Mechanic.

J. N. Donovan has been appointed Superintendent of Transportation, with headquarters at Tyler, Tex., succeeding W. C. Watrous, resigned.

Sioux City Terminal.—W. L. Stevenson, recently General Manager of the Kansas City Suburban Belt Line, has been made General Manager of the S. C. T. at Sioux City, Ia., with headquarters at the Union Terminal Station. (See Railroad News column.)

Southern.—J. C. Motley, Assistant Engineer at Atlanta, Ga., has resigned to form a partnership with H. F. Wilson, Jr., as Civil & Mining Engineers at Birmingham, Ala.

RAILROAD CONSTRUCTION.
New Incorporations, Surveys, Etc.

ALABAMA ROADS.—The business men of Anniston are considering two short coal roads, each about 25 miles long, one to the St. Clair coal fields at Coal City, and the other into Clay County. A third line is projected from Anniston to Tredegar, about 20 miles.

ALASKA & RUSSIA.—This company has been incorporated in New Jersey, with a capital stock of $100,000, to build a railroad from Port Clarence or Clarence Bay, southeast along the Alaska coast to Cape Nome. The incorporators are: Thomas Parker, Clifford W. Perkins and Kenneth K. McLaren. This is said to be a project by Cape Nome men to tap the gold fields along the shore of Behring Sea. J. S. Kimball & Co., San Francisco, are interested.

BALTIMORE & OHIO.—An officer confirms the statement that the Patterson Creek & Potomac and the Fish Creek lines were incorporated in West Virginia in the interest of the B. & O. The P. C. & P. will build a cut-off 6½ miles long from Patterson Creek, W. Va., on the Second Division, to a point on the Third Division to effect a saving of 10½ miles. Bids have been asked. This is not an expensive construction, with the exception of one tunnel about 4,000 ft. long.

The incorporation of the Fish Creek is preliminary to the building of another cut-off to avoid certain heavy grades on the Fourth Division between Grafton and Wheeling, W. Va., but there is no certainty that it will be built. (March 23, p. 193.)

The officer states that he has no information of the reported extension of the Salisbury Branch from Niverton, Pa., south to a point below Gransville, Md.

Surveys are in progress for the proposed cut-off from Frederick Junction, Md., east to Watersville. (May 26, 1899, p. 379.)

BEAUMONT WHARF & TERMINAL.—Work is to be resumed soon, according to report, on the belt line of 8½ miles at Beaumont, Tex. Some three miles were completed several years ago. (Dec. 30, 1898, p. 938.)

BELLEVILLE BELT.—Grading is reported completed on a belt line under this title to connect the Louisville, Evansville & St. Louis, the Illinois Central and the Louisville & Nashville at Belleville, Ill.

BOISE, NAMPA & OWYHEE.—Building is to be begun at once, according to report, on the northern extension from Nampa, Id., 27 miles to Emmett. Nine miles to Boise River was graded last year. J. M. Clark of Nampa, Id., is Chief Engineer. (Dec. 1, 1899, p. 835.)

BRACEBRIDGE & TRADING LAKE.—The Ontario Legislative Committee has approved the bill to incorporate this company to build from Bracebridge, Ont., to Maysville, about 14 miles; also to a point on Muskoka Lake. Peter Cockburn and Angus McLeod are among those interested. James Boyer of Bracebridge made application for the incorporation.

CALVERT, WACO & BRAZOC VALLEY.—The contract has been let, according to report, for another extension of this line from Calvert, Tex., north about 30 miles to Marlin.

CAPE NOME & GOLOFRIN BAY.—This company was incorporated in Washington March 16, with a capital stock of $10,000,000, to build railroads in Alaska. The incorporators are: Joseph Naden, J. B. Rawlings and E. F. Adams.

CAROLINA, KNOXVILLE & WESTERN.—This line, which was built some time ago from Greenville, S. C., northwest 16 miles to Marietta, but never operated, is now to be rebuilt, according to report. A suit is pending to compel the owners to operate the road.

CARSON & COLORADO.—This line is to be transformed at once, according to report, to broad gage, preparatory to its extension southward to the Southern Pacific. (Dec. 1, 1899, p. 835.)

CENTRAL OF NEW JERSEY.—Blaksley Bros. of Mauch Chunk, Pa., have been awarded the contract for rebuilding the famous Switchback Line which runs from Mauch Chunk, Pa., to Summit Hill, nine miles. The road is leased by T. L. & H. J. Munford of Mauch Chunk, and is operated as a pleasure road from May to November of each year.

An officer writes that preliminary lines only have been run for the proposed branch from Bath, Pa., east about four miles to Nazareth. (March 16, p. 177.)

CENTRAL TRACTION COMPANY OF INDIANA.—The proposed route of this company, recently incorporated in Indiana, is from Indianapolis, Ind., north 64 miles via Westfield, Noblesville, Cicero, Arcadia, Atlanta, Tipton and Sharpsville to Kokomo, with a branch line to Elwood. (March 16, p. 177.) The officers are given under Elections and Appointments. (Official.)

COVELLO & COLUMBIA RIVER.—Surveys are completed and a profile map made of the proposed route from Covello, Wash., southeast to Dayton. J. A. Thronson of Dayton is President. (Feb. 23, p. 127.)

CHICAGO, BURLINGTON & QUINCY.—Kilpatrick Bros. & Collins, according to report, have taken the contract for the Big Horn Southern line recently voted by the directors, to run from Toluka, Mont., southwest about 110 miles to Cody, Wyo. It is to be ultimately extended to the Yellowstone Park, in all about 250 miles. (Dec. 8, 1899, p. 853.)

CHICAGO, MILWAUKEE & ST. PAUL.—The Chief Engineer confirms the statement that surveyors are locating an extension from Bowdle, S. D., west to the Missouri River. Completed preliminary surveys show that the line will be about 41 miles long. As soon as located, the road will be placed under contract and the company expects to have it completed by Sept. 1. (March 9, p. 161.)

McIntosh Bros., of Milwaukee, Wis., have been awarded the contract for cutting down grades and reducing curves between Portage and La Crosse, Wis.

CHICAGO, ROCK ISLAND & PACIFIC.—Surveys are in progress for an extension from Audubon, Ia., the present terminus of the Atlantic-Audubon branch, to run northwest to Sioux City, Ia. The preliminary surveys are to be completed within two weeks. Reports state that a line will be built by the company into Sioux City within a few months.

CHICAGO, SPRINGFIELD & ST. LOUIS.—A railroad is proposed under this title to run from Staunton, Ill., northwest about 40 miles via Gillespie, Carlinville and Palmyra to Scottville. Most of the right of way is reported secured. Fred. Bartling of Hillsboro, Ill., is a projector.

CINCINNATI, RICHMOND & MUNCIE.—This company was incorporated in Indiana March 23, to build a railroad from a point on the Cincinnati, Hamilton & Dayton, to run northwest to Muncie, with further extensions northwest toward Chicago and southeast toward Columbus, O.

CLEARFIELD SOUTHERN.—The engineers are locating an extension from Paunce, Pa., on Clearfield Creek, to new coal territory on Potts Run. It is proposed to extend to within 1½ miles of Ansonville.

COCHITI & NORTHWESTERN.—This company was incorporated in New Mexico March 24, with a capital stock of $1,500,000, to build a railroad from Thornton, on the Atchison, Topeka & Santa Fe, to run northwest about 40 miles across the Rio Grande and up Pino Canyon to Bland, in the Cochiti mining district. The incorporators are: Samuel W. Thompson and Joseph E. Gillespie, of New York City; Charles J. Bartleson, of Minneapolis, and John S. Thompson and James H. Purdy, of Thornton, N. M.

COLUMBIA SOUTHERN.—Articles of re-incorporation are being considered, according to report, for a further extension of this line southeast across the State of Oregon to Canyon City, Burns, Prairie City, Granite and Ontario on the east side of the State, a station on the Oregon Short Line. The road is building to Shaniko, 62 miles from Moro, and is projected to Canyon City, 80 miles further. (Nov. 24, 1899, p. 819.)

DANSVILLE & MT. MORRIS.—Sufficient rail is brought, according to report, to complete relaying the entire 15 miles of this line.

EAST & WEST.—Surveys are in progress for the extension from Pell City, Ala., west about 30 miles into Birmingham. It is understood that the road

is also to be extended east to connect with the Seaboard Air Line. (Feb. 23, p. 127.)

EDMONTON & YUKON.—The Mayor of Edmonton, N. W. T., has received a letter from this company stating that Mackenzie & Mann will immediately begin building four miles of the road connecting Edmonton with Strathcoma, preparatory to work on the 50 miles subsidized from Edmonton westward. When completed, it is the intention to make this road a part of the Canadian Northern, now building by the same firm.

GREAT NORTHERN.—The company is building what is called the Boulder cut-off in Jefferson County, Mont., beginning at the main line near the south portal of Wickes's Tunnel, running south nine miles to another point on the main line.

ILLINOIS CENTRAL.—The company has let contracts for 5,000 carloads of stone to be used in diking its Fort Dodge & Omaha line along the Missouri River between Loveland, Ia., and Council Bluffs.

INDIANAPOLIS SOUTHERN.—The company expects to complete surveys in about 10 days for its line from Indianapolis, Ind., south 210 miles via Nashville, Brownstown, Salem, Paoli and West Baden to Rockport, with a connecting line from Salem southeast to New Albany. Some changes have been made in the original route. The prospects for building are good. Contracts will be let as soon as the question of finances is determined and surveys completed (March 16, p. 178.) The Osborn Co. of Cleveland, O., are the engineers. (Official.)

LAKE SHORE & MICHIGAN SOUTHERN.—Work is begun, according to report, on double tracking the line from Youngstown, O., north six miles to Doughton. It is stated that the double track is to be continued to Ashtabula.

LITTLE ROCK & HOT SPRINGS WESTERN.—A contract has been awarded, according to report, to James McCoppin for building a branch three miles long from Bauxite Station, Ark., into the bauxite fields. This may be the same line as that provided for under the incorporation of the Saline County, Bauxite & Granite. (Feb. 23, p. 128.)

LITTLE ROCK NORTHERN.—This company was incorporated in Arkansas March 23, with a capital stock of $8,000,000, to build a railroad from Little Rock north 180 miles to the State boundary line, and thence to Springfield, Mo. The principal stockholders are Andrew Johnson, Mena, Ark., and Charles P. Coleman, Philadelphia.

LOUISVILLE & NASHVILLE.—The Northern Alabama has effected permanent organization and active preparations are begun for building the road. It is projected from Cullman, Ala., on the main line, to run south about 74 miles to Bessemer. The new directors are: M. H. Smith, C. Quarrier, J. H. Ringgold, H. W. Bruce, W. D. Hines and W. W. Thompson, of Louisville, Ky., and J. M. Falkner, of Montgomery.

MEXICAN ROADS.—Britton Davis, General Manager of the Compania Minera Corralitos, Chihuahua, Mex., and Morgan Jones, of Fort Worth, Tex., are seeking a location for a railroad in the Sierra Madre range, Mexico, and seem to have decided on a line from Casas Grandes into the range, to develop the mining properties there.

Senor Luis G. Ramirez and Senor H. Heredia of La Piedad, State of Michoacan, have received a concession for a railroad from La Piedad, on the Mexican Central to La Piedad Cabadas, a distance of 12 miles. The road is to be completed within 18 months and animal traction is to be employed at first by the concessionaires.

The Governor of the State of Jalisco has granted a concession to Francisco Martinez Negrete to build three tramway circuits in the city of Guadalajara, and connecting as the three main points Analso, Capilla and Jesus, and Agua Azul. Mr. Negrete may be addressed at Calle San Francisco, Apartada 89, Guadalajara.

MOBILE & OHIO.—Bids will be opened at Mobile on April 2 for 1 1/3 miles of track at Blocton, Ala.

NEW YORK CITY RAPID TRANSIT.—Ground was officially broken on Saturday afternoon, March 24, in front of the City Hall for the new Rapid Transit tunnel. The work was practically opened on the following Monday by John Pilkington, who has a contract, the first given out, for lowering the sewer several feet on Bleecker St. It is understood that sub-contracts for building the tunnel will not be let until after April 1.

NEW YORK, NEW HAVEN & HARTFORD.—An officer confirms the statement that it is the intention to enlarge the yards at Poquonock, Conn. The extent and speed with which these improvements will be made depends upon the requirements of the business.

No arrangements have been made or definite plans prepared for abolishing grade crossings in Pawtucket, R. I. (March 23, p. 194.)

As to reported improvements at Fall River, Mass., there is no intention of building additional lines, but the elimination of the grade crossings will very likely proceed as soon as the commission appointed to determine the plans has made its report.

Plans have been prepared, according to report, for freight yard enlargement and other improvements at Middleboro, Mass.

NICKEL BELT LINE.—The Ontario Legislature on March 23 passed the bill incorporating this company to build from a point on the main line of the C. P. R., between Whitefish and Worthington, to run northeast 12 miles to Denison in the District of Algoma. Another branch will run from a point in the Township of Garson, Nipissing District, 10 miles to connect with the Stobie branch of the C. P. R. J. M. Clark of Toronto is interested. (Feb. 16, p. 112.)

PANHANDLE & GULF.—This company, which has recently filed amended articles of incorporation, has completed its preliminary organization. It is to form the Texas section of the Kansas City, Mexico & Orient line proposed from Kansas City southwest to Topolobampo, Mexico, on the Pacific. The officers are given under Elections and Appointments. (March 16, p. 178; K. C., M. & O., March 9, p. 161.)

PECOS VALLEY & NORTHEASTERN.—Surveys are reported made for an extension from Miller, N. M., southwest about 150 miles to El Paso, Tex.

POLK COUNTY.—F. M. Stearns of Cleveland, O., is interested in this proposed line from Spartansburg, S. C., to run north about 35 miles to Rutherfordton, N. C. Polk County has voted $100,000.

PRINCETON, SPRING VALLEY & LA SALLE.—The stockholders on May 2 will vote on the proposition to increase the capital stock to $1,000,000, and to authorize a like amount of bonds for building and equipment. The line is projected from Princeton, Ill., east about 20 miles, via Spring Valley to La Salle. Alfred E. Case of Chicago is President, and F. R. Bryant of Princeton, Secretary.

QUEBEC & LAKE ST. JOHN.—An officer writes that the company will spend about $850,000 in improvements, of which $250,000 will be for new rolling stock and the rest for ballasting, cutting down grades, improving terminals and relaying 30 miles with heavier rail.

QUEEN & CRESCENT.—Condon & Callahan of Knoxville, Tenn., according to report, have taken the contract for building the Cincinnati Southern road around Tunnel No. 27, near Harriman, Tenn., and work is to be begun at once. (Feb. 16, p. 112.)

The Natchez, Miss., Board of Aldermen has passed an ordinance granting the New Orleans & Northwestern a franchise for building a track connecting with the Yazoo & Mississippi Valley line of the Illinois Central.

QUEEN ANNE'S.—An extension is under consideration, according to report, from Queenstown, Md., to a point on Kent Island, 12 miles, to be run in connection with a ferry line to Baltimore.

ST. CROIX SHORT LINE.—This company was incorporated in Wisconsin March 24, with a capital stock of $100,000, to build a railroad from Superior to run south 155 miles through western Wisconsin to St. Paul, Minn. The incorporators are: A. L. Sanborn, F. C. Ellis, W. E. Fagg, L. W. Claude and E. F. Starck, all of Madison.

SHREVEPORT & RED RIVER VALLEY.—A contract is reported let for further extension of this line southeast to Colfax, La., about 25 miles. The road is now completed from Coushatta southeast 73 miles to Luella. (Oct. 13, 1899, p. 719.)

SOUTHERN MISSOURI & ILLINOIS RAILROAD & BRIDGE COMPANY OF CAPE GIRARDEAU.—This company was incorporated in Missouri March 19, with a capital stock of $150,000, by Newman Erb and other officers of the Southern Missouri & Arkansas, to build an extension of that line from Cape Girardeau, Mo., southeast to Gray's Point, and thence over a railroad bridge across the Mississippi to a connection with the Illinois Central and the Chicago & Eastern Illinois. The C. & E. I. is building an extension to Thebes and the bridge will probably furnish a connecting link to the St. Louis Southwestern.

SOUTHERN PACIFIC.—Land has been bought, according to report, at Galveston, Tex., for improvements, including additional tracks.

SOUTHERN RAILWAY OF CAPE BRETON.—Surveys are completed and the line is ready for building from Point Tupper, on the Intercolonial, to run east 18 miles to St. Peters. It parallels the Intercolonial for about three miles from Point Tupper, and then crosses the river Inhabitants and skirts the Inhabitants Basin.

SUNSET.—This company was incorporated in California March 15, to build a railroad from Gosford on the McKittrick Branch of the Southern Pacific, to run south about 30 miles to the Sunset oil fields. Messrs. Jewett & Blodget of Bakersfield are back of the project and among its incorporators.

TERRE HAUTE & SOUTHWESTERN.—A second survey is to be made next month, according to report, for this proposed line from a point on the Indiana State line near Terre Haute, to run southwest about 200 miles to a point on the Mississippi River in Alexander County. Horace C. Pugh of Terre Haute has recently been in New York to interest capitalists in the road. (Sept. 22, 1899, p. 668.)

TEXAS & NORTHEASTERN.—This company is building a railroad from Village Mills, Tex., on the Southern Pacific, southeast to Le Verte, on the Gulf, Beaumont & Kansas City, and has completed about 15 miles to Morton.

TEXAS & PACIFIC.—Surveys are begun, according to report, for an extension from a point near Donaldsville, La., to run south along the left bank of Bayou La Fourche.

TEXAS ROADS.—John W. Maxcy of Houston, Tex., writes with reference to the contemplated State road that it will run from the wharf terminal on the Brazos River through the State farm about six miles to what is known as Peach Point. Mr. Maxcy is to have charge of the railroad building, and also the building of wharves, sugar houses, etc. The work will be done by State convicts over a very level country presenting no physical difficulties. (March 2, p. 146.)

VERSAILLES & OSGOOD.—This company has been incorporated in Indiana, with a capital stock of $700,000, to build a railroad between the points named in the title.

WEST BRANCH VALLEY.—A new survey is to be made, according to report, for this line from Clearfield, Pa., east 104 miles to Williamsport. A. E. Patton, Curwensville, Pa., is President. (July 14, 1899, p. 516.)

GENERAL RAILROAD NEWS.

ALABAMA & VICKSBURG (Q. & C.).—The stockholders at Jackson, Miss., on March 19 voted to increase the capital stock by $350,000. (Feb. 23, p. 128.)

CAROLINA & NORTHWESTERN.—President W. A. Barber is reported to have bought 1,000 shares of stock of his company from York County, S. C., the condition being that the road is to be made standard gage prior to Jan. 1, 1901. The line runs from Chester, S. C., northwest 109 miles to Lenoir, N. C. (Aug. 29, 1899, p. 604.)

CINCINNATI, JACKSON & MACKINAW.—The Reorganization Committee, consisting of F. P. Olcott, Geo. R. Sheldon and F. W. Whitridge, announce a second modification of the plan of reorganization of Dec. 10, 1895. The plan includes the Detroit, Toledo & Milwaukee and the Cincinnati Northern, and provides as follows:

The mortgage on the D., T. & M. for $1,500,000 is to be satisfied, the bond canceled and the capital stock reduced from $1,500,000 to $1,000,000, and placed in the treasury of the Cincinnati Northern. (D., T. & M., April 15, 1898, p. 286.)

The Cincinnati Northern is to replace the securities heretofore issued by $1,500,000 first mortgage 5 per cent. 50-year gold bonds to the Central Trust Co. as trustees, on the line from Franklin to Jackson, and on all the other properties of the company except the capital stock, as above noted, of the D. T. & M., and the properties known as the Cincinnati Terminals; also $2,500,000 of preferred 5 per cent. non-cumulative stock and $1,500,000 common stock. The first mortgage bonds and the common stock may be sold by the committee for not less than $1,350,000 and the proceeds applied to the discharge of the Central Trust Co. loan of $1,000,000 and other debts or expenses. The preferred stock of the C. N. is to be issued to an amount equal to 50 per cent. of the par value of the principal of the $4,198,543 first mortgage bonds of the Cincinnati, Jackson & Mackinaw, heretofore deposited, and shall be exchanged either for the original certificates of deposit or for the securities issued against the same under the first modification of the plan. The committee expects to arrange for the sale of the proposed bonds and common stock for $3,500,000, which would pay the debts of both lines, leaving the company free to deal with the Cincinnati Terminals and with the D., T. & M. The new current liabilities of the two roads on Jan. 1, 1900, were estimated at $150,000, besides which $50,000 is needed for improvements. It is estimated that the earnings for 1900, after paying operating expenses, etc., will show a deficit of $50,000. The C. N. was incorporated in 1897 to take over a portion of the property of the C., J. & M. (C., J. & M., April 25, 1898, p. 150.)

CINCINNATI NORTHERN.—See Cincinnati, Jackson & Mackinaw.

DETROIT, TOLEDO & MILWAUKEE.—See Cincinnati, Jackson & Mackinaw.

FITCHBURG.—The stockholders on March 22 ratified the proposed lease of the line to the Boston & Maine by a vote of 93,412 shares of preferred stock, and 52,265 shares of common stock in favor, and 28,447 shares of preferred stock in opposition. (March 23, p. 194.)

KANSAS CITY & NORTHERN CONNECTING.—Foreclosure suits have been brought by the Guardian Trust Co., and the Provident Life & Trust Co., as trustees, under the two mortgages. (Oct. 20, 1899, p. 738.)

KANSAS CITY, PITTSBURGH & GULF.—Judges Thayer & Phillips, in the Federal Court at Kansas City, Mo., on March 19 confirmed the sale of this property to the Reorganization Committee. (March 23, p. 194.)

LEBANON SPRINGS.—The sale of the Vermont section of the line, about six miles long, extending from Bennington, Vt., to the State line, has been postponed from March 21 until April 25. The New York end is now operated under the title of the Chatham & Lebanon Springs. (March 16, p. 178.)

LOUISVILLE & NASHVILLE.—General mortgage bonds of 1880 to the par value of $279,000 have been drawn for payment at 110 on June 1. (Oct. 6, p. 702.)

MEXICAN NATIONAL.—Announcement is made that after March 31 deposits of A and B bonds will not be received for conversion except on a penalty of £2 per $1,000 A bond, and £6 per $1,000 B bond, in addition to the assessments of £1 per $1,000. Holders of second mortgage A bonds are entitled to a payment of 4½ per cent. from the earnings of 1889 on account of past due interest, payment to be made at 52 Wall St., New York, on and after April 20. (Dec. 15, 1899, p. 872.)

NORFOLK & WESTERN.—The statement prevalent in the papers that the Pennsylvania Railroad Company has bought a controlling interest in the N. & W. is apparently untrue. There appears to be no doubt, however, that a block of the stock has been bought by men identified with the Pennsylvania, with the intention of securing representation on the Board of Directors. This is in accordance with the policy of the Pennsylvania in its recent purchases of stock of the Chesapeake & Ohio and the Baltimore & Ohio.

NORTHERN PACIFIC.—Senator Penrose on March 22 introduced a bill into the United States Senate, and John Binham on the same day introduced a similar bill into the House, inquiring into the reorganization of this road. The bills were introduced by request of Cornelius Chadwick and W. S. Hassell of Philadelphia, representing non-assenting stockholders of the old company. (Jan. 5, p. 14.)

PITTSBURGH, CLEVELAND & TOLEDO(B. & O.).—The reorganization committee notifies holders of certificates of the City Trust Co., New York, for first mortgage bonds under the bondholders' protective agreement of Aug. 25, 1899, that a proposition for the sale of these bonds has been approved by the committee. Deposits of other bonds will be received until further notice. (Sept. 22, 1899, p. 668.)

RIO GRANDE WESTERN.—A circular has been issued to stockholders by the directors recommending an authorization of an additional issue of $5,000,000 common stock.

SIOUX CITY TERMINAL.—The new company has taken possession of the property of the Sioux City Terminal Railway & Warehouse Co., including 13 miles of track in Sioux City, Ia. (Sept. 1, 1899, p. 620.)

THIRD AVENUE (NEW YORK).—The Metropolitan Street Ry. Co. acquired a controlling power in the directorate of the Third Avenue line on March 21 through the election of a number of new directors. H. H. Vreeland, President of the Metropolitan, was elected Temporary President. Henry Hart, the Vice-President, was continued in office. (March 23, p. 194.)

TOLEDO, ST. LOUIS & KANSAS CITY.—This property was sold at public auction at Toledo, O., March 27 to representatives of the bondholders' committee. (March 9, p. 162.)